Products finishing

FRED W. VOGEL, Editor

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Products Finishing

FEW meetings in the history of the American Electroplaters' Society have created quite as much interest and enthusiasm in problems pertinent to the finishing industry as the 29th annual convention held last month in Boston, Mass. Few meetings have been so well attended or have evoked so much spontaneous discussion of the material presented.

In recognition of the splendid work they have done, this month we would pay a special tribute to those men who, under the direction of Mr. Joe Barron, assumed the responsibility of their tasks with sincere resolve to do their best for the good of the organization and primarily for the advancement of the science of electroplating.

To Mr. Ellsworth T. Candee, the newly elected president, and his assistants for the coming year, Mr. Charles C. Conley, first vice-president; Mr. George Wagner, second vice-president; and Mr. Maurice R. Caldwell, third vice-president, falls the responsibility of guiding the American Electroplaters' Society through one of the most critical periods in the history of the organization.

Under the leadership of these capable men, the work of the organization—educational, membership, and so on, will be carried forth diligently and with the full confidence and cooperation of the entire society.

Attractive ... for La...

By CARLETON CLEVELAND

THE casual observer is not likely to attach great importance to the need for an attractive finish on such a utilitarian implement as a lawn mower. Yet the Jacobsen Manufacturing Company, Racine, Wisconsin, producers of power mowers, have found, after experimenting over a period of years, that sales volume responded favorably after the right note as to eye appeal had been struck. High quality material and skilled workmanship are, of course, first essentials in the life and performance of a mower as in any other piece of mechanical equipment, but the attractive appearance of the finished piece is the attention getter.

The main color scheme of the Jacobsen mowers has undergone some evolution in recent years—from a battleship grey to a blue, and then to the present bright orange. The new Lawn King and Estate models, for instance, have all the qualities of efficiency, dependability, ruggedness, and power embodied in a streamlined unit attractively finished in brilliant orange, with a bright aluminum finished cutting reel, while a streamline hood, in black wrinkled finish and stainless steel trim, encloses the engine and muffler. All painting and finishing is done in the Jacobsen plant, with the exception of the streamline hood.

The finishing department is in two separate divisions—one where continuous production of a lighter model is proceeding, and one where heavier mowers and miscellaneous pieces, such as handles, sickle bars, cutting reels, etc., are painted. In the section where the continuous production on the Lawn Queen is maintained, the complete mower is assembled and placed on a special fixture for passage along a gravity roller conveyor leading to the wash and paint spray booths, machined parts having previously been passed through a degreaser of the solvent and vapor type (using a trichlorethylene preparation as a cleaning medium), on leaving the machine shop. When the operator in the wash booth is ready for a new mower, he merely raises a hinged door, permitting the next mower coming down the line to enter

...ive and Serviceable Finishes ...for Lawn Mowers

the booth. Here it is given a thorough wash with a naphtha, and air gun dried with the aid of compressed air. Thereupon it is pushed through another hinged door directly into the paint spray booth, still on the roller conveyor. Here the operator masks off the cutting reel and other sections that have previously received a coating of aluminum paint. He then gives the mower a one coat spraying of a combination of wax and enamel in bright orange, after which a hinged door on the opposite side of the booth is raised and the mower permitted to roll into an infra-red light tunnel, consisting of some 40 lights staggered in such a way that every part of the mower is reached by the infra-red rays. Experience at this plant has shown that a better finish results when the coating is dried under the infra-red rays.

Work proceeds in such a manner that six mowers are constantly in the light tunnel. Each mower, as painting is completed, is pushed into the light tunnel, which automatically pushes one out at the other end. The time required for drying is about one hour.

After completing its journey through the light tunnel, the mower rolls on toward the packing table, where the rubber tires are placed on the wheels. Special felt pads soaked with black paint are used to "black in" the name and design on the wheels. At this point the mower is rolled off the special fixture onto a

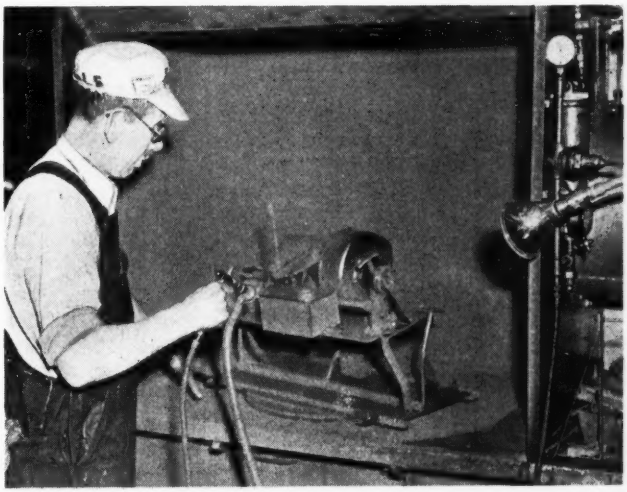

Fig. 1—Applying the finish coating to a Lawn Queen mower unit.

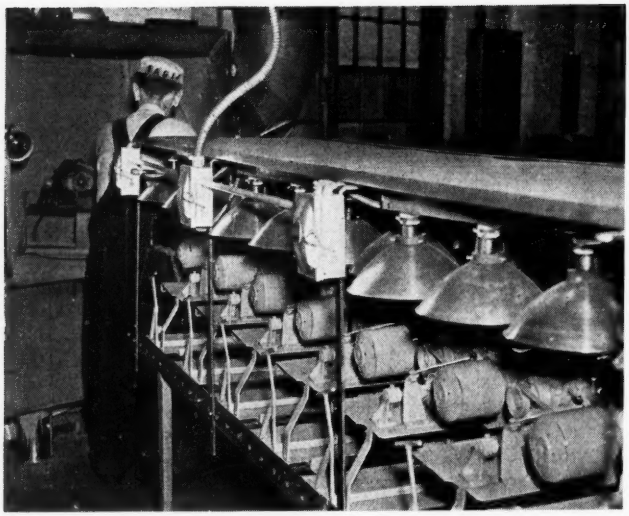

Fig. 2 — The finish coated mower units pass through the infra-red light tunnel shown here. The lamps are located in staggered formation.

crate bottom already placed on a connecting roller conveyor, and then bolted to the crate bottom by means of special hook bolts. Name plates, decalcomania transfers, instructions, tags, etc. are added, and the mower is then given an actual operating inspection by the final inspector. Next a paper hood is placed over the entire unit for protection, and the flexible crate is wrapped around it and fastened, and the bottom and top nailed on. Thus crated ready for shipping it is lifted off the packing table with a block and tackle, traveling on an overhead tramrail, and deposited onto a waiting floor truck, which, when completely loaded, transports the mowers either to storage or to the shipping room.

The heavier mowers—the Estate, the Lawn King, and other models—are assembled and finished in another section of the plant. In this section is a booth for naphtha spray cleaning and two paint spraying booths, where the mowers are given the orange coating. These booths are also used for painting the handles, cutting reels, and other miscellaneous parts and products of the company. Because of the greater weight of these larger mowers, they are handled with air hoists, traveling on overhead tramrails. The general procedure at these wash and spray booths is much the same as at the other booths previously described.

The completely assembled machines are brought to the naphtha booth for a cleaning, then proceed on to the spray booth for the orange coating, after certain portions previously coated with aluminum paint have been masked. After this they are lifted out of the booth and moved on for room drying. Production at this section of the plant is not continuous on one type of mower, hence different models of the mower move through either booth for the spraying.

The same type of paint is used as on the smaller units. The handles, after being painted, are hung on wheeled racks, consisting of two parallel horizontal bars, for drying. Other small parts, after painting, are set up on wheeled trucks and left for room drying. Compressed air is supplied from two units to all spray booths, where pressure tanks and cup guns are used.

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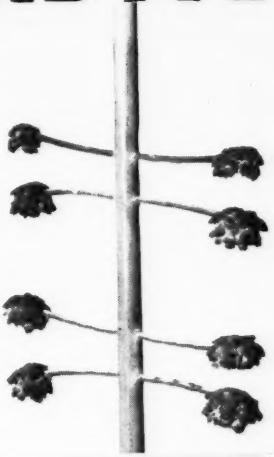

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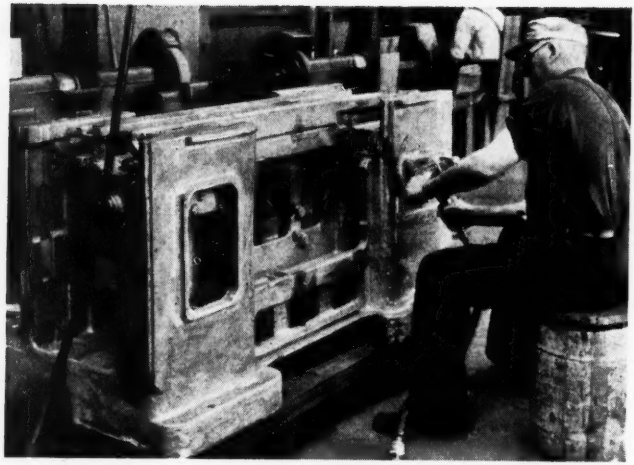
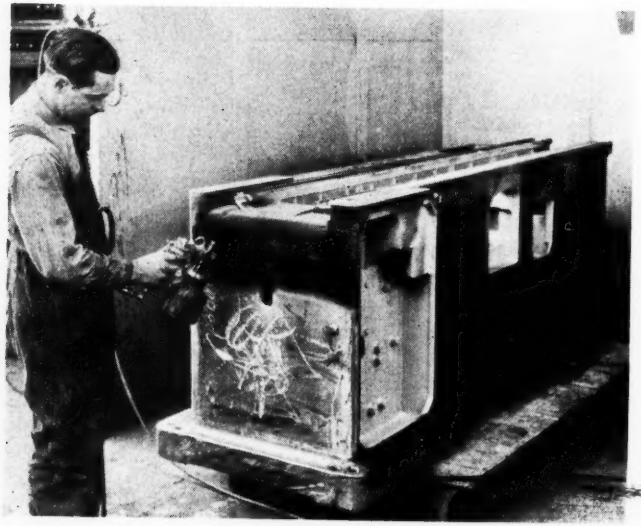


1. Snagging Castings

After being weighed, the machine tool castings in the Heald plant are moved into the snagging room where they are rough and finish snagged preparatory to sending them out into the shop for machining.

Finishing a Machine Tool

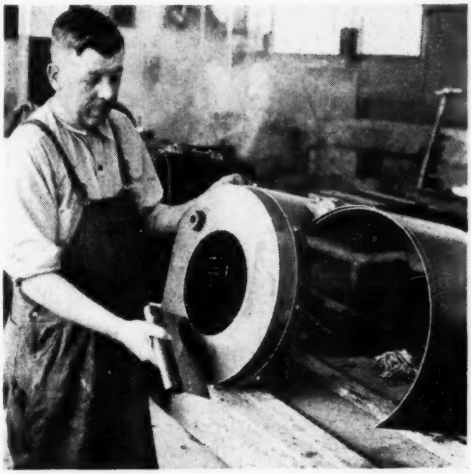


2. Spraying on a Priming Coat

After the castings have been machined, they are sent to the paint room where they are first thoroughly cleaned with gasoline to remove oil and chips. Following the cleaning, they are put into spray booths and given a coat of primer which is sprayed on as shown in this illustration.

3. Glazing Castings with Filler

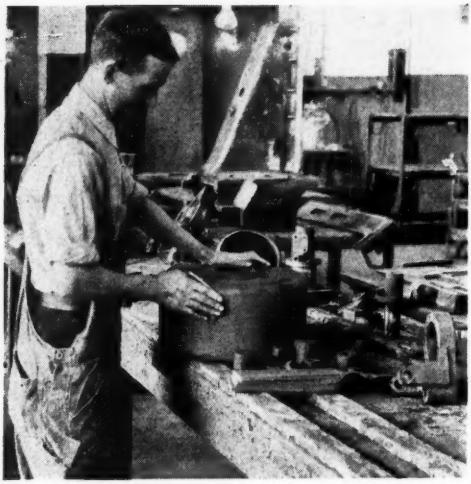
Following the spraying of the primer, the castings are glazed with a coat of filler. This material is applied in an even coating over the entire surface of the casting, thus filling all crevices, sand holes, and uneven areas on the surface.



This pictorial presentation on the finishing of a machine tool was furnished through the courtesy of THE HEALD MACHINE COMPANY, Worcester, Massachusetts, and is designed to give the readers of this magazine a better understanding of the thorough finishing methods employed in a modern machine tool plant.

4. Sanding Castings

Following the filling operation, the castings are sanded or rubbed with the sanding machines shown in this illustration. This power driven unit enables the operator to smooth down the surface quickly and easily.

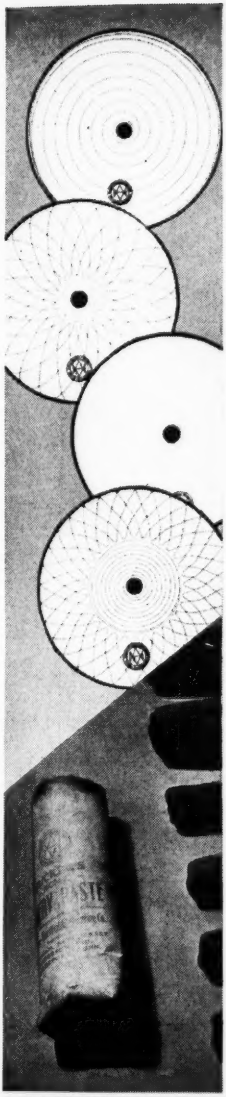


5. Rubbing Castings

Where it is impossible to rub the castings with the power driven machine, the rubbing operation is done by hand as shown here. A fine grade of sand paper provides the necessary abrasion to remove high spots and otherwise prepare the surface for a coating of finishing material.

6. Final Finishing of Castings

After the parts have been rubbed, all cast parts such as the bases, tables and other parts where there is a surface on the inside that does not get finish painted, a coat of yellow sealer is sprayed on. This is to seal the iron and also eliminate any chance of dirt or dust. Also, it makes it pleasanter working while putting the pipes inside. Then, while the casting is still in the spray booth, a dust coat of color lacquer is put on. This seals the filler and gives it an even coat of color. Following is a wet spray of color which completes the painting job. From here the castings are moved into the stock room.



3 WAYS TO MEET PRESENT NICKEL PLATING CONDITIONS

1. If the thickness of nickel is reduced, less pressure must be used in coloring the thinner deposit. Therefore, softer buffs are necessary such as H-VW-M standard Tractor, Economy Full Disc, Petal Sewed and Spirally Sewed.

   (Use a quality lime finish such as Nocast which colors up quickly without removing nickel.)

2. If a heavy deposit of copper is applied prior to a thin coating of nickel, the copper must be buffed to a high lustre to obtain the rust prevention formerly secured by heavier nickel deposits. Here again, softer buffs like H-VW-M standard Tractor, Economy Full Disc, Petal Sewed and Spirally Sewed are essential.

   (Use a lime compound like Acme Pink Finish for small articles, or Beechwood 16-P for larger articles, both of which cut and color, produce a beautiful finish, and clean up well on the work.)

3. If the base metal is steel, more care must be given to polishing to prepare the base for the thinner nickel deposit. H-VW-M Sisalin Sections answer this need.

   (Use fast cutting steel compound such as 6-M-161, prior to plating.)

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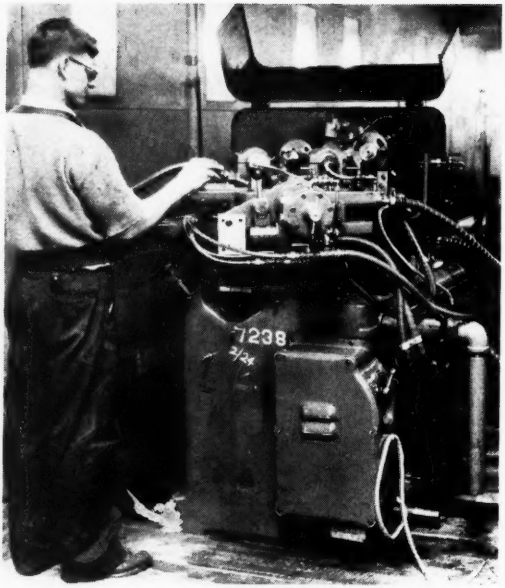
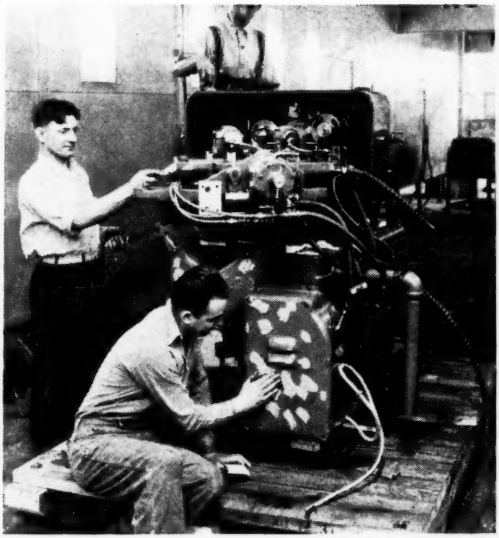


7. Machine is Thoroughly Cleaned before Painting

The machine is rolled into the spray booth where it is given a bath of Savasol No. 5, thoroughly wiped, and then dried with an air hose as shown in this illustration.

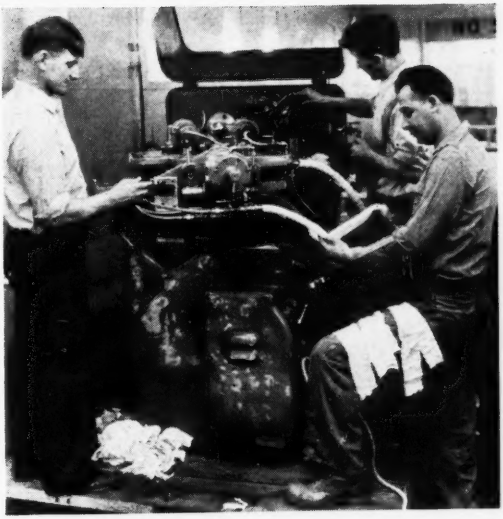
8. Spot-Putting Bruised Places and Sanding

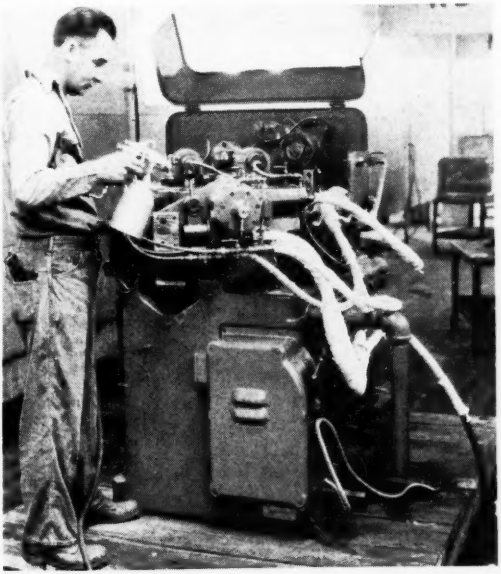
Once clean, the machine is entirely gone over and refilled on all marred or scratched spots, as shown, by the men with putty knives. The re-puttied portions are carefully rubbed down after which the entire machine is thoroughly cleaned and wiped.



9. Slushing Polished Surfaces and Covering with Cloth

All polished surfaces are slushed and the hose and other parts on which it is not desirable to put slush are carefully covered with cloth.

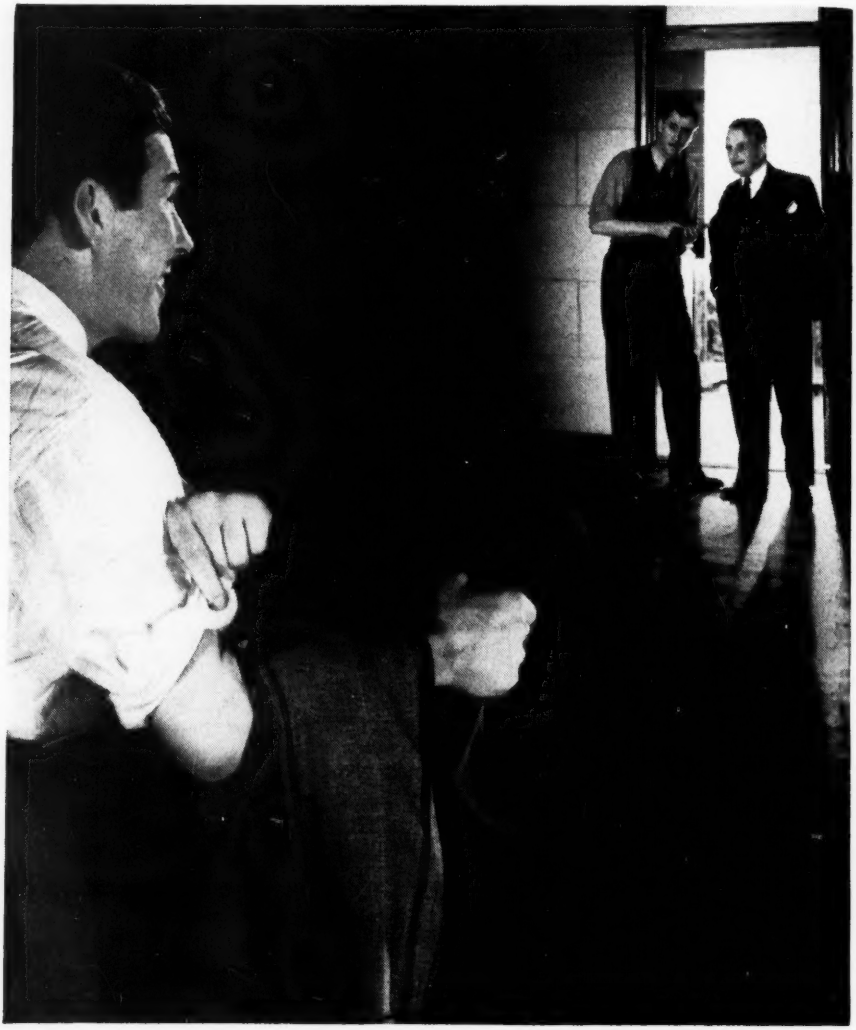




10. Finish Spraying Machine

After the machine has been slushed and pipes covered, it is given a light coat of color to cover all of the filling spots. It is then given a coat of thin shellac. The reason for this is to hold the color the same tone all over as some of it might otherwise soak into the preliminary filled spots. Following the coat of shellac, it is given a coat of very thin color coat. Following the thin coat, it is given a wet coat or a regular coat of color paint.

He rolled up his sleeves....



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IT WAS just a routine call on a maker of metal soap dishes. But this Du Pont man found the plant had been shut down for a week because of trouble in the finishing department. The clear dipping lacquer on their cadmium-plated metal pieces was "blushing"—and they hadn't been able to discover why.

Then the Du Pont man rolled up his sleeves and went to work. First, he suggested a "retarder" thinner to slow up the lacquer drying. But still each piece had a dull whitish haze instead of the brightness of cadmium plate. Next, as a test, he dipped one of the bright plated pieces in glycerin. The haze still appeared . . . even in this transparent fluid! Perhaps the trouble was in the plating bath . . . not the lacquer.

The cadmium plate was grainy, he found. And the haze was caused by light reflecting from this bright grainy surface through the lacquer. So he recommended filtering the plating solution. This did the trick! The plating came smooth. The "blushing" was stopped and the pieces no longer took on a whitish haze. So the plant went back into production—the Du Pont man went on his way.

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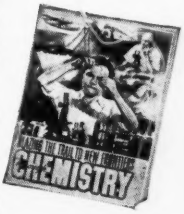

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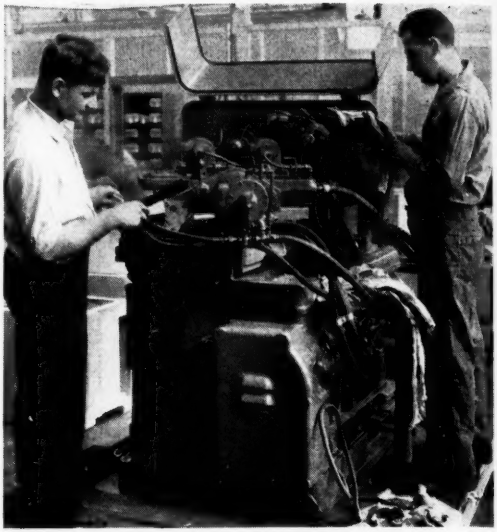
FINISHES DIVISION, WILMINGTON, DELAWARE DU PONT REG. U.S. PAT. OFF.

11. Removing Slush and Cloth

After the machine has been painted, the slush is peeled off with a putty knife carrying with it all of the paint which was deposited on the finished surfaces. The cloth is removed and the machine is ready for boxing and shipping.



12. Slushing All Finished Surfaces

The polished surfaces are all slushed and on all large flat surfaces, such as the table and ways, tin foil is pressed onto the grease. This insures against dampness reaching these parts during storage or shipment.

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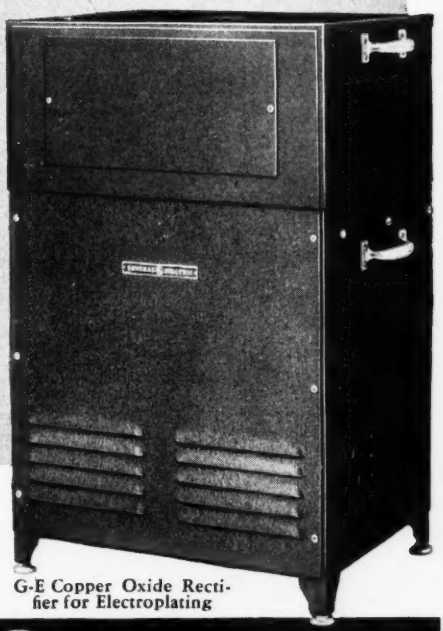

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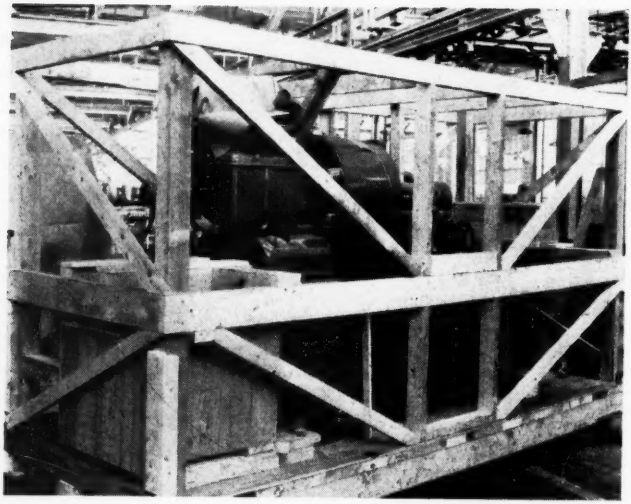
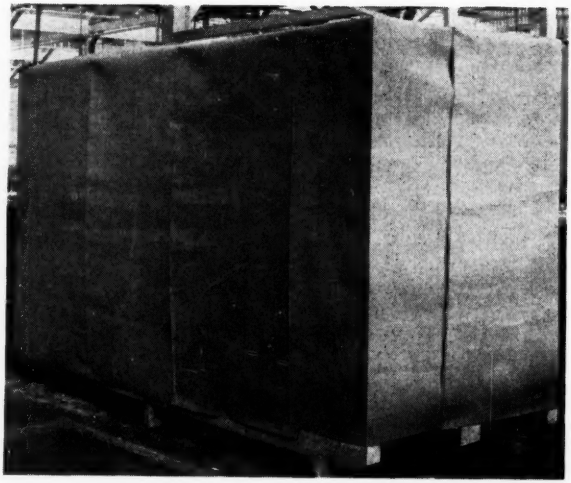


13. Framing for Boxing

A crate is built around each individual finished machine and this framework is securely fastened to the skids on which the machine is mounted. The careful methods employed in crating the machine are positive assurance against possible damage to the finish while the units are in transit.

14. Wrapping

Whenever the machine is to be shipped abroad, waterproof paper is placed over the entire framework, as shown in this illustration. This is another precautionary measure to preserve the beauty and durability of the final finish.



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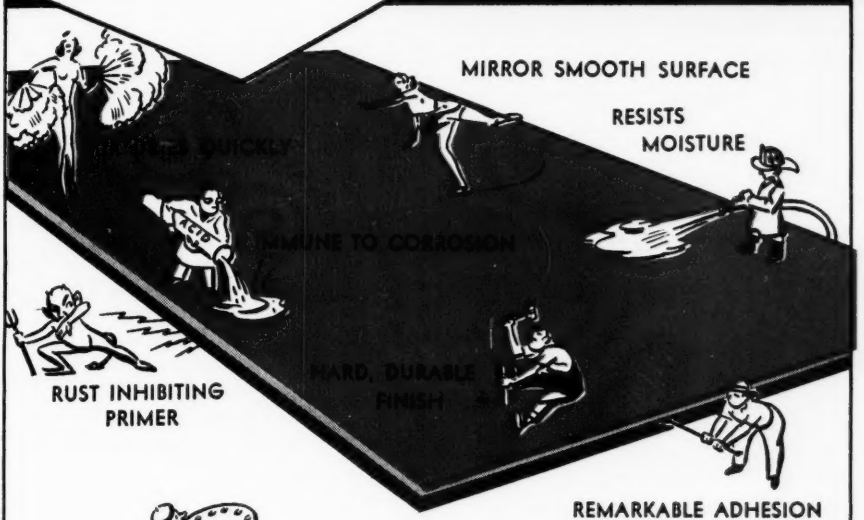

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Trap Installation Saves Fuel on Steam Heated Tanks

By FRANCIS A. WESTBROOK

THE Bar-Rusto Plating Corporation, Kansas City, Mo., has recently speeded up its operations and simultaneously reduced its fuel bill by installing traps to drain the steam lines which heat some 35,000 gallons of cleaning and plating solutions. These results have been accomplished without any other changes in the existing equipment.

This concern operates a complete metal plating plant including such processes as Udylite-cadmium plating, electro-galvanizing, hot dip galvanizing, Bonderizing, Parkerizing, Alumiliting, electro-color plating, de-

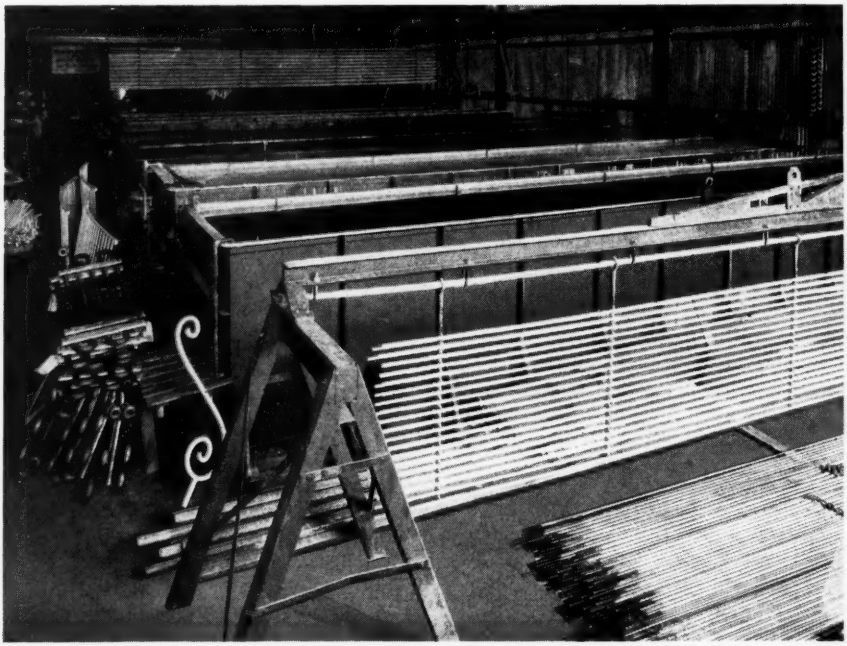

Fig. 1—A general view of one section of the plating department showing cleaning and rinsing tanks in the foreground.

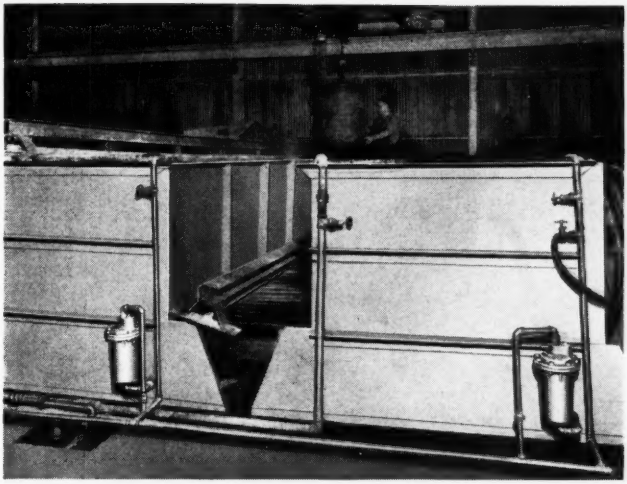

Fig. 2 — Individual steam traps have been installed at each tank as shown in this illustration.

greasing, electrocleaning and pickling, bright nickel, copper and chromium plating. Approximately 35,000 gallons of heated solutions are required for most of these processes and these must be heated to the proper temperature every day. From five to fifteen tons of metal are plated daily, the sizes of the work pieces varying from small screws to structural members up to two tons.

Some of the tanks in which the solutions are kept are as large as 850 cu. ft., but all of them are of good size. They are heated by steam coils

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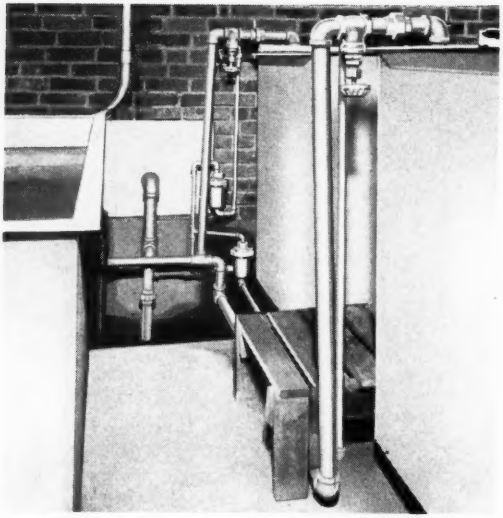

Fig. 3—Another view showing the method of installing individual steam traps at each solution tank.

and in order to be sure of obtaining the correct temperature, and without undue delay, it is necessary that the circulation of live steam through them is not interfered with by condensate or air. The presence of condensate also makes it more difficult to maintain a constant temperature and causes a waste of heat. To this end a trap has been installed at each coil.

There are twenty-five traps installed below the coils. The largest have 1 in. pipe connections and the smallest a ½ in. connection. The steam pressure is 25 lbs. The trap sizes were selected with a view to handling condensate and air under peak or pickup loads and that this was done properly is indicated by the advantages experienced.

Tygon Bulletin No. 1612. Bulletin No. 1612 on the subject of "Tygon" Paint which was developed for the protection of metal surfaces against corrosion is now being issued by The United States Stoneware Co., 60 E. 42nd St., New York, N. Y. According to the bulletin, Tygon is particularly recommended for jobs involving very severe corrosive conditions. Some of the principal applications of Tygon are — painting chemical and process equipment, pumps, tanks, fans, and so on.

Tygon paint will withstand the action of acids, salts, and alkalies, including nitric, hydrofluoric, hydrochloric, sulfuric, and chrome acids. The material may be brushed, sprayed, or baked. It is available in a wide range of colors, including white, black, and clear.

A copy of bulletin No. 1612 will be sent free upon request.

"For Dependable Protection of Plant and Property." This is the title of a six-page folder announced by the Detex Watchclock Corp., Dept. M-6, 76 Varick St., New York, N. Y., describing and illustrating the Detex Newman—a portable watch clock.

Copy free upon request.

"Better Casters" is the title of a four-page folder now being published by the Metzgar Company, 112½ Logan St., S.W., Grand Rapids, Mich., illustrating and describing two complete lines of industrial truck casters, all of which are fitted with floor-protective "Metzgar" End-Wood Wheels from 2½ to 10 inches.

Copy of folder free upon request.

Goodrich Conveyor Belt. A catalog section on its new turnable conveyor belt has recently been issued by The B. F. Goodrich Company, Akron, Ohio.

The catalog section describes the belt's functions and reasons for its patented design, gives details on construction, and proper method of turning the belt.

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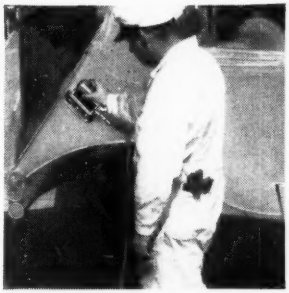
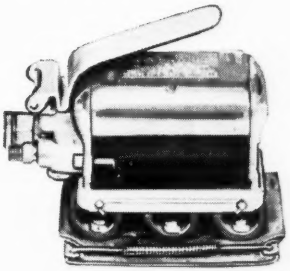


"SANDY" at work on plane maintenance. Triples sanding speed on metal, wood and plastics with *quality* finish.



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Barrel Finishing of

Factors in the Barrel Finishing of Plastics following Metallizing and Plating

By H. LEROY BEAVER

Barrel Finishing Consultant
Lansdale, Pennsylvania

IN the preceding paper, we discussed but one of many methods used for covering with a coating of metal, either plastics, or other nonmetallic objects so as to form a base for the plating in the conventional way of most of the various popular metals either by still tank or barrel plating methods. In this paper we discuss some of the factors relative to the procedure and materials used in the various processes of barrel finishing to which such parts would be susceptible.

Shortages of various metals used as base materials as well as other metals used in anode form for plating purposes have been suggested at intervals during the past year, and more especially within the past four months, when it seemed apparent that there might be some difficulty in securing a supply adequate to both defense and peace time requirements. Now it is within this last mentioned period that we have received the most inquiries, and they are of much the same import and that is, "If we are required to use some substitute basis material, that can be metallized and plated, just what can we expect of barrel finishing procedure?" And then an equally important question, "Will it be possible for us to use our present burnishing barrels and burnishing materials for barrel finishing substitute materials, whether of plastic or of some other metallized materials?"

To those who have followed this series from the beginning, the above two questions would have already been answered, and it is principally for the benefit of those readers who have broken into the series somewhere along the line, that the discussion that has gone before at least in part, will have to be repeated to emphasize the underlying factors that would apply in such problems.

Answering the first question, we may say that barrel finishing has progressed to such a point, and especially so in the past five years, that we can safely say that we who conduct most of the barrel finishing research have developed materials, methods and instrumentalities, that will enable the average manufacturer to satisfactorily finish such materials by barrel processes, with the very definite assurance that production

...ng of Metal Products

volume may be increased and unit costs lowered. While some of these processes may be very well carried out in barrels of much lighter construction and larger volume, this does not mean that present barrels installed and in operation cannot be adapted to handling these lighter materials.

The question is not so much one of the type of barrel to be used, as it is of the type of material composing the burnishing mass. We have repeatedly stressed the point that as between parts to be finished and the materials used for the finishing process, that is, the load supplying medium or abrasive or lubricating materials, that the relation of the specific gravity of the parts to be finished as it related to the specific gravity of the burnishing mass was always a matter of the utmost importance.

To those who have specifically inquired as to whether they could use their present burnishing materials on metallized and plated plastics we would say "no," and the reason for this answer lies solely in the wide variation between the specific grav-

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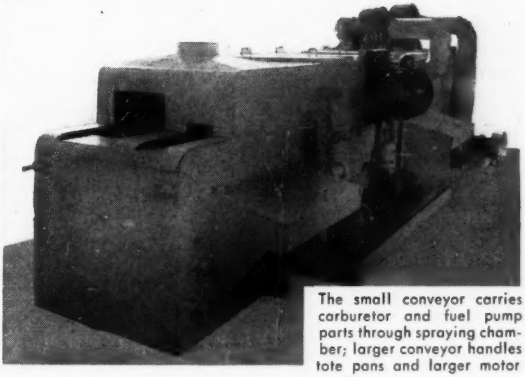

The small conveyor carries carburetor and fuel pump parts through spraying chamber; larger conveyor handles tote pans and larger motor parts.

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ity of steel burnishing materials and the specific gravity of metallized plated plastics. Let us first consider that taken as a whole, and whether the size range runs from 1/16 in. to 1/4 in. and whether of round steel balls or hardened steel shapes, we may safely use the figure 4.9 as representing the specific gravity of the average steel burnishing material mass.

In the matter of plastics, we find a specific gravity range that will vary in the untreated plastic of from .95 to 1.7, and even after metallizing and plating the range would hardly be more than that represented between the specific gravity of from 1.22 to 1.33 or possibly 1.35, so that it can be seen that the burnishing material mass will be easily four times greater than that of the parts to be finished, and what would happen if it were attempted to barrel finish these far lighter specific gravity parts in the heavier material we perhaps can make more clear by a simple illustration.

Let us take an ordinary glass of water and toss into it a common ordinary cork. It will be seen that the cork floats on the surface of the water for the reason that it has buoyancy on its own part. Now let us take a piece of plastic of identical size to that of the cork and toss this into the same glass, and it will immediately plunge to the bottom of the glass, showing that it does not have the same buoyancy as the cork.

Now in a burnishing barrel we can make almost the same illustration, because if we toss a plastic part into the burnishing mass and revolve the barrel the plastic will immediately come to the top of the mass. If we toss in a piece of steel or brass whose specific gravity is equal to or greater than the burnishing mass, the heavier material will remain in suspension in the mass. The reason the plastic part will come to the top of the mass is not because it has buoyancy on its own part in the same sense as the cork, but because it is lacking in inertia or rather in specific gravity, and it is the simple illustration of a part with specific gravity of let us say 1.30 trying to maintain itself in a mass whose specific gravity is 4.90.

Hundreds of experiments have been conducted in trying to make parts of great specific gravity variation stay within a burnishing mass but without avail, because the lighter parts once being forced out of the heavier mass are unable to regain their position within the mass, and they thus become "floaters," as they are called in barrel finishing parlance, and by floating on top of the mass they receive little or no burnishing action. That is the reason why so many barrel operators have said to us, "Barrel finishing is no good for plastics because we tried it and got no results whatever."

In each and every case it was not barrel finishing as such that resulted in failure to get results, but a lack of understanding of the relation of the specific gravity of the plastic parts to that of the burnishing material mass attempted to be used. In all too many cases, operators of barrels with no understanding whatever, even of the primary essentials, are all too prone to immediately constitute themselves both judge and jury as to whether a thing can or cannot be done in barrels.

We do not recall any operator ever admitting to us that the fault lav altogether in his lack of understanding of the proper procedure and materials to be used, for invariably it is barrel finishing itself that is the in-

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adequate part of the problem, and which leads us to the simple observation that no manufacturer can pick any employee at random from his yard crew, put him in charge of barrel operations and expect to obtain anything intelligent in the way of results. It requires just as much skill to intelligently operate barrel finishing equipment as it does to operate any other machine tool, and the sooner manufacturers using barrel processes recognize this, just that much sooner will they get results from their equipment that will reflect the skill, intelligence and understanding of the operator in charge.

To the author of this series who has made hundreds of research surveys of burnishing processes in plants covering a wide area and variety of parts and materials, it does not require a very prolonged dialogue to enable him to determine whether Guiseppe or Dimetrius, generally more familiarly known as either "Joe" or "Jim," should go back to their wheel barrow in the factory yard, or stay on in charge of the barrel finishing equipment. When barrel installations are in charge of men that we would term above the average of ordinary intelligence, that extra degree of intelligence is invariably reflected in the work coming from the barrels by reason of what we may easily express in one word, and that is "understanding." And following this digression, we go back to our text as follows:

If barrel finishing material of a specific gravity of 4.9 is sought to be used on parts whose specific gravity is from 1.20 to 1.33 and proves to be utterly unsatisfactory, does this not immediately point to the requirement for a burnishing material mass that would be composed of material approximately equal in specific gravity to that of the parts to be finished? We know that when burnishing material mass and parts to be finished are fairly equal in their specific gravity relation, that the results are invariably all that we seek, and on the other hand we know too that when there is a wide variation, the results are invariably unsatisfactory. The problem now is the development of a burnishing material mass whose specific gravity is closely equivalent to that of the parts to be finished.

When we speak of processes whereby plastic parts may be metallized, we do not in any sense restrict the metallizing process to plastics alone, but consider that it might be equally well adapted to the metallizing of other materials than plastics. Hence, if a material can be found whose specific gravity is close to that of plastics, reduce that material to appropriate sizes for barrel operation, and the parts need not be round, for in that form they would certainly be the least efficient, metallize such small parts in the same way as plastics are metallized, then plate them to a sufficient thickness to withstand wear, and we would have a material more nearly comparable in specific gravity to that of the parts we wished to finish and our chances of successful operation would be that much greater.

Now let us examine for a moment present mass materials used in finishing plastics as such, without a metallic coating. We find that maple sawdust is the principal mass material. This is treated with various combinations of oils, greases, waxes and abrasives, and is variously mixed or blended with wood pegs, wood cylinders and sometimes wood balls, the latter not intended as burnishing mediums but as separators to prevent bunching of the work in process. We

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find here that our specific gravity set-up is almost a complete reverse of the condition we have described as existing between steel burnishing materials and plastics and to give a more adequate illustration or may we call it a mental picture, we need only say that maple sawdust will average about twenty-four pounds to the even bushel.

Beech wood pegs, and that is the material generally used, are marketed in standard bags of four bushels and such a bag will weigh just exactly ninety-six pounds. Now contrast to this either a bushel basketful or a four bushel bagful of any kind of plastic parts you have ever seen and if you try to lift either the bushel basketful or bagful of plastics in comparison with the sawdust or pegs the wide variation will be immediately apparent. Now in operating parts in a barrel with such a mass we just effect the opposite, because the parts, in normal operating speed, will lie beneath the mass and the greatest part of the action on them will come from contact with the inner side of the barrels and from the lightweight mass, which at least partially explains the very long lengths of time required to secure adequate finishes on this type of materials. The answer lies obviously in the development of a mass equivalent or closely so in specific gravity to that of the part being finished.

Here we would also like to point out another practice that we have found being followed in a number of factories. It seems that once a barrel operator has worked with a barrel and steel burnishing materials, that he develops a complex that seems to tell him that no barreling operation ever could be successfully carried out unless steel balls or steel shapes appeared in the picture somewhere, and so, and for reasons that we have never had intelligently explained, many operators add steel balls or steel shapes to sawdust and wood peg mixtures where they do no good whatever, and where, if too high barrel speeds are used, they may by their action of impact do real damage to parts in process. For purposes of comparison we need only say that one peck of maple sawdust will average about six pounds and one peck of steel burnishing material about one hundred pounds and it is simply mechanically impossible to merge these two mediums into a satisfactory burnishing mass.

It is true that metallized and plated substitute materials for use in place of materials now most urgently needed for defense production, have not reached any great volume. This volume will be very greatly increased if our information is correct and within a comparatively short time.

Here we have a definite problem in finding a suitable and completely adequate material for use in barrels. Obviously the answer lies in additional research. We might say that in the four weeks just passed we have conducted fifty-four tests with various materials and combinations in a search for a material that would be comparable in specific gravity and that would function satisfactorily. Each test seems to come closer and give more encouragement than the preceding one, which adds to the hope that when the time comes for the real need of this material, that we will have developed something that can be immediately used in production, that will provide entirely satisfactory finishes and that will in a large measure reduce the now long operating cycles, so that greater quantities of materials may be produced per day at lower costs both for the material mass and for the unit cost of the articles operated.

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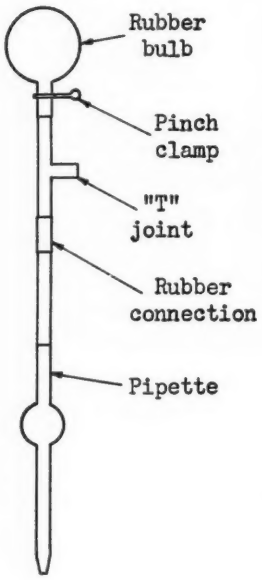
Chemicals

Modern Gold Plating

By JOSEPH B. KUSHNER, CH.E.
Metal Finishing Consultant
New York City

"THERE'S one consolation about not getting much in the way of defense work," a gold plater acquaintance of mine said the other day," at least we don't have to worry about Priorities."

In all probabilities, the gentleman was right. Gold is something we have plenty of, as anyone who has been reading the papers these last eight years knows, and its defense uses are insignificant. Outside of the gold plating of insignias and a few odds and ends in the way of electrical contacts, certain radio parts and infra-red ray reflectors, there is very little defense use for gold as a plating metal. As a solid alloy component, it has very little use also, outside of filling the teeth of our armed forces, if you want to call that defense work.



However, the situation may change, if some inventive genius discovers a new use for it. Let it be remembered that gold fulminate, which salt is made by platers every day in cutting down their gold, is a highly powerful explosive. If the mercury situation gets bad (most of our mercury comes from Spain, though we do get some from Mexico and the West Coast) and we can't produce enough mercury fulminate—the spark plug of every high explosive shell—we may have to look for substitutes.

Yet even if gold remains off the Priorities list indefinitely, there are certain points in this connection that

Fig. 45—Cyanide pipette. Instructions for use are as follows: Force air out of rubber bulb by opening pinch clamp and squeezing. Close clamp. Place finger over open end of glass "T" joint and slowly open the pinch clamp. This will permit liquid to be sucked up into the pipette. When liquid level reaches mark, close clamp, keeping finger tightly over open end. To release the fluid, remove finger from "T" joint.

Part 11

should be of interest to the gold plater. Priorities have frightened a large number of the plating fraternity. Nickel anodes are scarcer than hen's teeth, cadmium, zinc and tin are on their way out and at this writing it looks as though even copper is going to join the rapidly expanding list of vanishing American commodities. These metals, the foundation material of electrodeposition, are quickly being made in accessible to the plater, unless, of course, he has a 1A rating. The question is: what to do? Platers have to plate. If a manufacturer discovers that he can get along with a chemical dip or a lacquer job during the crisis, then platers will have a difficult job reselling him on plating after the war is over.

The natural and obvious answers to this self-put questions are two: (1) Find substitute metals with which to plate. (2) Conserve what you have now and continue plating with insoluble anodes. Course number one seems pretty much out of the question. There are no other metals that we have plenty of that are not "strategic," except gold and silver. We've got many billions of dollars of gold buried at Fort Knox and an enormous amount of silver floating around. No, I'm not saying let's gold plate plumb-

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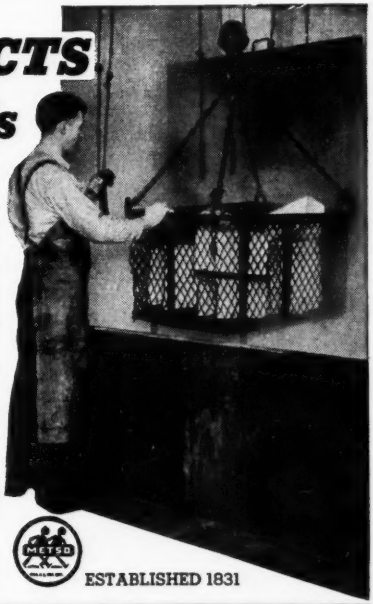

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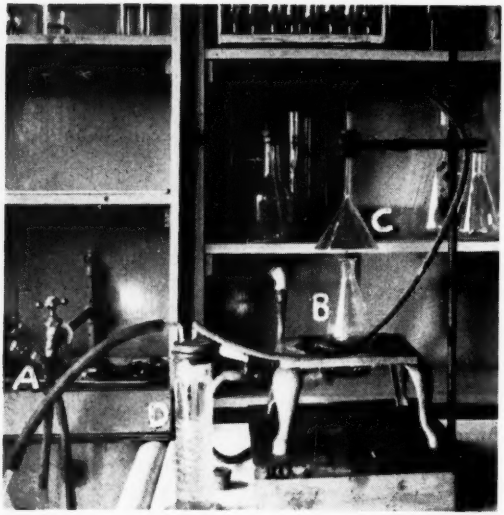

Fig. 46 — Fume Absorption Unit water aspirator pump (A) exhausts fumes from mouth of Erlenmeyer flask (B), through funnel (C) and gas absorption bottle (D) containing a concentrated solution of sodium hydroxide.

ing fixtures and hardware and the thousand and one items that are now protected against corrosion by the electrodeposition of the previously mentioned base metals. The thought does occur, however, that there are certain marginal applications where even this is conceivable. Remember, for example, that the National Silver Producer's Research Project in Washington found that it was possible to deposit a relatively non-porous deposit of silver only .0001 in. thick on some forms of steel, with the thought of substitution for tin as a lining material for tin cans.

Silver and gold, as we have pointed out on other occasions, can protect an underlying base metal from corrosion only if they cover the base metal completely with an impervious, non-porous layer. Silver and gold are cathodic with respect to the base metals and will cause them to corrode very rapidly if for any reason an opening exists in the deposit that permits the presence of moisture at the interface. If we can deposit a non-porous deposit of these metals, that is extremely thin so we don't have to use too much of them, we may have a possible answer to the substitute problem. If we are concerned with the possibility of silver tarnishing because of the presence of a sulphur bearing atmosphere or material, then we can first put on a thin, non-porous plate of silver and follow up with an even thinner non-porous flash of gold and we've got something. In this connection, there is a similar application being made in defense work. Wire coils which must carry high frequency alternating currents in radio transmitters and receivers are first given a heavy plate of silver which acts as a highly conducting "skin," followed by a light gold plate to prevent the sulphide tarnishing of the silver and consequent increase in electrical resistance. Of course, if abrasive wear is a consideration, forget that we even mentioned the subject.

With regard to the second course, conservation, a great deal of comment has been made. Platers mention the scrap anodes they sold for junk a year ago with something akin to a tear in their eyes and it has now become popular to speak about dragout losses. Previously dragout losses were considered only in the case of gold and silver and even then it was considered an insignificant item in plating conjured up by the theoreticians to confound the practical man.

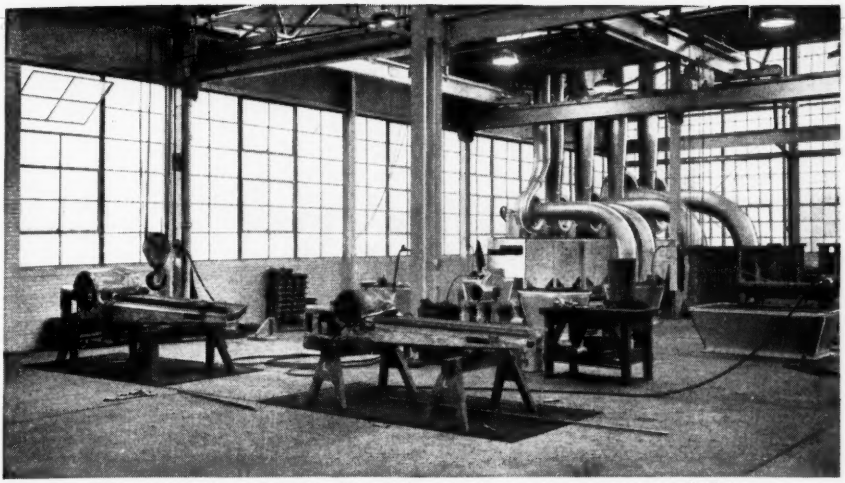

Illustration shows how the Kirk & Blum Systems, in connection with Roto-Clones, collect fine dust from portable grinding operations at the Cincinnati-Bickford plant. Note gratings, under the work, through which dust is drawn.

Take DUST *Out of* INDUSTRY

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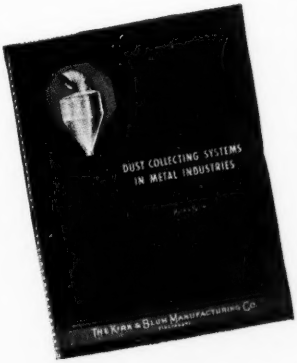

AT THE Cincinnati-Bickford Tool Company's enlarged finishing department, KIRK & BLUM Engineers have again demonstrated their ability to provide modern industry with better, more economical dust control. Ten stations—4 floor grills, 4 rectangular tables, and 2 round tables—are served by KIRK & BLUM Systems, which exhaust a total of 51,000 cu. ft. of air per minute. All dust from portable tool grinding operations is carried downward through the grilled openings under the work.

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DUST CONTROL SYSTEMS

At gatherings of the American Electroplaters' Society these days, someone always brings up the subject of saving and economizing on metals and salts by chemical control of the plating solutions. In making

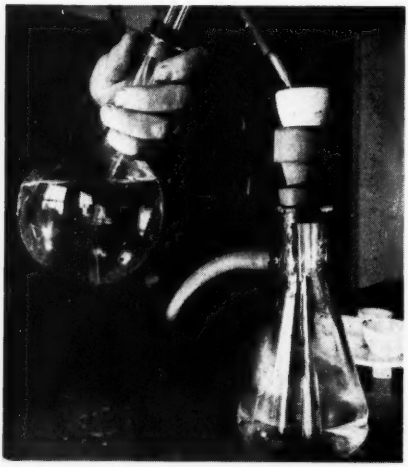

Fig. 47—Washing gold precipitate in Gooch crucible

additions of chemicals to the plating bath, the trend is definitely from "dump it in" to "weigh it out." We are beginning to realize that cyanide does not grow on trees.

What has all this to do with gold plating? Considerable. Gold is the original plating metal upon which a great deal of control and conservation is supposed to have been practiced because of its costliness. Accordingly, the gold plater in this, his fellow plater's hour of need, should be able to teach him a few tricks about control and conservation.

A number of years ago we preached the doctrine of dragout recovery, in gold plating. A great deal of interest was shown in it—but mostly by non-gold platers. Then we advised more control in gold plating[1], and got a similar response. The truth is, very little control or conservation is practiced by the gold plating industry as a whole.

Ask the novelty jewelry manufacturer how much gold is being plated on his items and he refers you to his plater. "He knows," he says, "that's what I pay him for."

So you ask the plater how much gold he is putting on these items and he tells you: "Oh, about 60 seconds of gold." How much is that? Did he note the current density? Did he "tap" or strike the cathode bar or was the work in continuous contact with it? What is the cathode efficiency? When you point out that 60 seconds of gold is just about as meaningful as "two pounds of Sunday" under these conditions, he says, "Mister, we just get the work out. You theory boys do the figuring."

We go back to the manufacturer and tell him that 60 seconds worth of gold gives us no clear idea of how much he is putting on the items; isn't there some other way he can tell us. "Well," he says, "I can give you a pretty close idea from my figures. According to our records we purchase five ounces of gold a week when plating these items and we turn out about 10,000 of them weekly. That figures out to 1¾ cents per item plated."

So we ask him if he has ever had any of the pieces assayed to see how close the actual amount on the piece is to his figure? Does he know how much of that five ounces of metal is lost by dragout? Does he know how much of that five ounces is plated out on the wires, how much is lost in careless manipulation?

"Then, Mr. Manufacturer, how do you know you're plating 1¾ cents worth of gold on each item?

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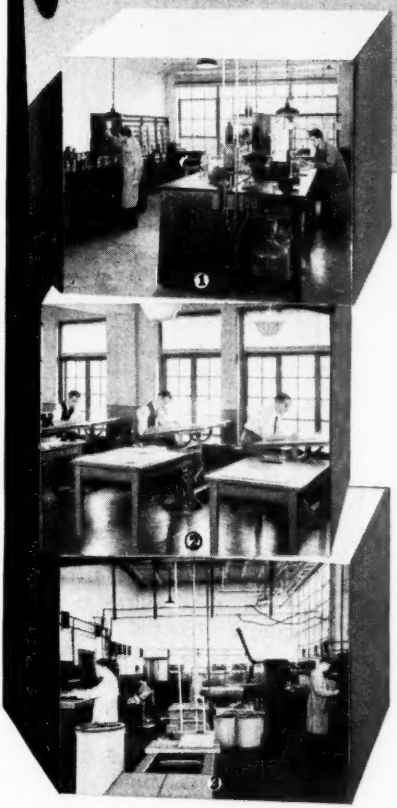

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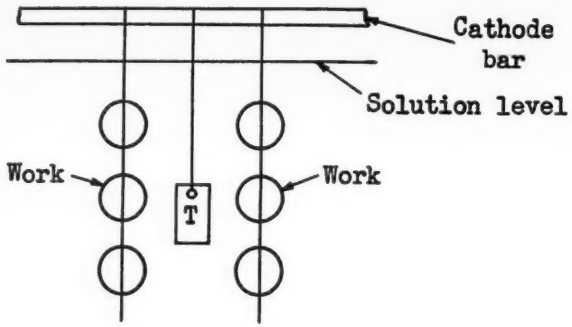

Fig. 48—Carat test piece in use

"You may only be putting on a cent's worth. That means your wastage may be as high as 43 per cent. If you had the proper control system you might be able to save as much as $75 a week on your gold and still get the results you get now."

With this, the manufacturer mentally multiples 75 by 52, thinks of the mink coat he denied his poor little wife last year because "economy demanded it," and collapses in a heap.

In all seriousness, however, this is very often the situation in gold platting today. Very little is known in most cases about the distribution of gold in the plating plant; how much goes to waste and how much is used productively and economically. But now Priorities and defense have at last made manufacturers "conservation conscious," they are really ready for Gold Control.

Gold Control

The essential factors in "gold control" of electrogilding operations are two:

(1) Knowing how the gold is distributed in the plating plant.

(2) Governing the distribution so that the maximum amount of gold goes into economic production and the minimum amount goes to waste.

The first point involves a chemical system whereby all losses are kept at a minimum and records are kept of the path of the gold through the plating plant. It is understood, of course, in conjunction with item one that chemical composition of the gold plating bath with regard to other substances present such as cyanide, carbonates, and so on, is also under strict chemical control. With these thoughts in mind, we are going to consider some analytical procedures for gold in both solid and liquid form.

analyses, that is, knowing how much gold is plated out, the carat of the gold and the amount of gold in the plating bath and in the recovery rinses. The second point involves the introduction of a method or

There are a number of methods for determining gold in solution, either gravimetric, volumetric or colorimetric. Colorimetric methods that give accurate, reproducible results for the concentrations of gold usually found in plating baths are unfortunately not yet available, even though there is a crying need for them. The writer has been engaged with the problem off and on over a number of years but has not yet found a suitable procedure. Of volumetric methods, the method first described in the plating literature by Haas[2], involving an idiometric titration, is best; of the gravimetric methods one described by Kushner[3] gives excellent results. Of the two methods we are heartily in favor of the gravimetric because it is much simpler to use. There are no long drawn out evaporations, titration and back titrations

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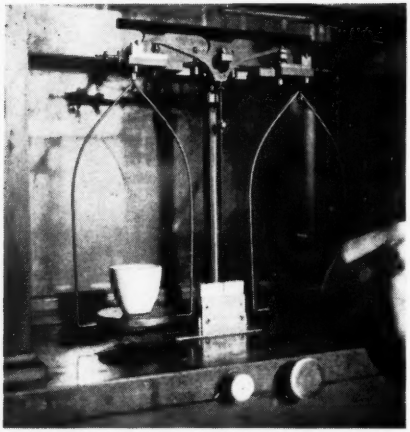

Fig. 49—Weighing fold precipitate in Gooch crucible

with unstable reagents, and involved computations. The only expensive piece of equipment required is a chemical balance. But the time saved and accuracy gained with the balance, particularly where gold is concerned, make the investment eminently worth while.

Gravimetric Method for Gold in Plating Solutions

1. With the gold plating bath at normal liquid level, pipette off a 25 cc sample after first stirring thoroughly to overcome stratification and waiting a few moments to let sludge settle down. Incidentally, if you don't like the possibility of inhaling cyanide in getting your sample you might make use of the simple gadget shown in Fig. 45. This permits you to draw up the exact amount and release it without touching your lips to the pipette.

2. Empty the pipette into a 250 cc Ehrlenmeyer flask.

3. Add approximately ½ gram of sodium nitrate. In our original variation[3] we added silver nitrate from a burette until faint turbidity, but this complicates the method if silver is to be determined.

4. Place the flask under a hood, or if you have no hood use a suction and absorption system as shown in Fig. 46. This can be easily rigged up with an aspirator, a large funnel and a gas absorption bottle that contains a concentrated solution of sodium hydroxide. Very slowly and carefully add 35 ccs of concentrated sulphuric acid avoiding inhalation of any fumes that may escape, since they contain hydrocyanic acid gas. There is a tendency to violent evolution of the carbonates present which may cause spattering, unless the acid is added quite slowly. Now turn on the heat under the flask, gas or electric. Heat until boiling and continue heating until the gold separates out as a brownish sponge. The supernatent sulphuric acid should be absolutely clear. While the heating is going on, the suction should be kept on continuously, since toward the end of the reaction sulphur trioxide gas is liberated.

5. Permit the acid to cool off a bit then pour off most of the supernatent acid. Now very carefully add water and filter into a weighed Gooch crucible.

6. Wash several times with hot water. If silver is present in the plating bath, wash with a little dilute ammonia followed by a wash with clear water and alcohol. Dry and weigh the crucible with the gold in it. The weight of gold in grams contained multiplied by the factor 4.88 gives the ounces (troy) of gold per gallon of solution.

Occasionally a slight hitch will develop if there is present in the solution a large quantity of iron salts such as ferrocyanides. If this is the case, ferric sulphate, $Fe_2(SO_4)_3$, which

is insoluble in concentrated sulphuric acid and only difficultly soluble in water, precipitates, with and on the gold, as a grayish yellow powder. If this occurs, wash the precipitate with hot water several times by decantation right in the Erlenmeyer flask and add a little dilute sodium hydroxide solution which converts the ferric sulphate to ferric hydroxide, a red dish brown precipitate. Now add a little dilute nitric acid and heat to dissolve this reddish precipitate. Wash several times more with hot water and filter as before on a Gooch as shown in Fig. 47.

The filtrate and washings from this method can now be analyzed for other metals as follows:

Copper is determined by the thiosulfate method.

Nickel is determined by the dimethyl glyoxime method or the cyanide method such as is used in nickel plating bath determinations. Silver is determined by precipitation as chloride and weighing or by a thiocyanate determination.

Zinc can be determined by any standard method.

The methods mentioned will not be described as they can be readily found in any standard text on the subject such as Scott.

In case gold is to be determined in dragout recovery rinses we suggest the use of a 50 cc sample inasmuch as the concentration of gold in the rinse may be quite low. If a 50 cc sample is taken, increase all factors proportionately and multiply the weight of gold found by 2.44 to get the troy ounces per gallon.

Determination of Gold in Solid Form

There are two particular cases in which it is desirable to know how much gold there is on a given object.

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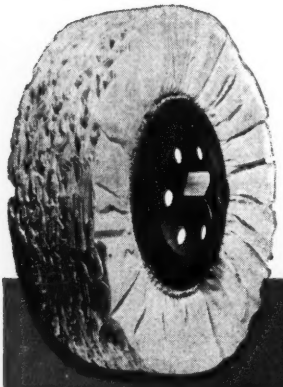

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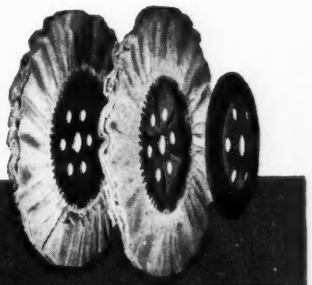

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In the first case we want to know exactly how much gold is being plated on a given piece so that we may make a cost evaluation and in the second case we want to know how much gold is on a given piece so that we can determine the carat at which the bath is depositing. There are other reasons too, such as determination of cathode efficiency and current density characteristics but these come under the heading of testing and stripping of gold deposits which will be discussed in another paper. The second case will be discussed first since it is the more complicated one.

Obtaining the Carat of the Gold Plating Bath

Purchase some pure silver foil, about 22 gauge, and cut it into rectangular strips 1 in. wide and 2 in. long. These are your test strips for determining the carat of an alloy plating bath. Punch a tiny hole in the top center of each strip. Scratch or stamp an identifying mark on each one of these strips and weigh off each one on an accurate balance and record the weights for future reference. Twist a thin piece of copper wire through the center hole of a number of these pieces so as to have them ready for use whenever needed. If a carat test is to be made, suspend one of these test or pilot pieces by its copper wire from the cathode bar right with the regular work and adjacent to it, so that the piece is about 2/3 of the way down in the bath as shown in Fig. 48. Put it right through the regular cleaning operation with the other parts to be plated and place it in the plating bath with the regular work. The piece should be plated with an average load to insure accuracy. When the load is plated, remove the piece with it, rinse well in clear water and then use an alcohol dip and dry. You are now ready for testing.

1. Remove the copper wire by untwisting and weigh the test piece. The difference between the original weight and the final weight gives the weight of the deposit.

2. Drop the test piece into a 250 cc Erlenmeyer flask and add 50 ccs of dilute nitric acid.

3. Heat until all the silver is dissolved from under the gold plate. This can be ascertained when bubbles of gas stop forming on the piece and brownish nitric oxide fumes are no longer visible. The action usually starts at the point where the hole has been punched since this is the spot where bare silver is exposed and gradually creeps along under the plate, undermining it until the gold plate crumbles off, exposing the remnants of the silver base. If there is any doubt as to the completion of the reaction, add a few additional ccs of nitric toward the end and note if there is any additional bubbling. If there is, the reaction is not finished.

4. Rinse the flaky and crumbled gold deposit several times by decantation with hot water.

5. Now add to the disintegrated gold plate in the Erlenmeyer flask 25 ccs of concentrated hydrochloric acid. To this add a few crystals of potassium chlorate. Add these crystals very carefully as there is a tendency for them to cause splattering when they hit the acid. Heat the flask until all the gold is dissolved. (This method for dissolving the gold, while a little longer than the standard aqua regia method avoids the repeated evaporations and boilings needed to drive off nitrates. Note: Do not try to cut down your gold by this method since it will not work when the gold is in heavy massive form. It dissolves gold only when thin or in fine-

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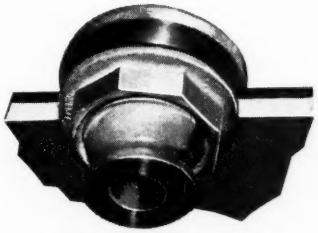

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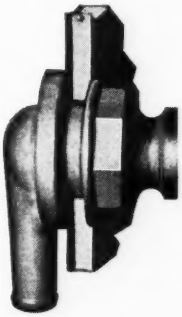

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ly divided form. If necessary, add additional hydrochloric and chlorate crystals to complete the dissolution. Continue boiling until the excess chlorate that may be present, is destroyed. This can be determined when the characteristic chlorine odor is no longer present.

6. Dilute the solution with 50 ccs of water. If a precipitate forms, it is silver chloride and should be filtered off on a weighed Gooch crucible for a silver determination. Wash several times with hot water and add washings to the filtrate which should be kept in another 250 or 500 cc Erlenmeyer flask.

7. With a piece of glass tubing, under a hood, pass sulphur dioxide gas into the filtrate from a small cylinder. These compressed gas cylinders are inexpensively obtained from any of the compressed gas manufacturers and last for a number of determinations. Heat the solution while the gas is being passed to facilitate precipitation of the gold. When the gold is completely precipitated, usually in about 15 mintes, turn off the SO_2 and wash down the glass tubing into the flask to clean off any adhering metal. The precipitate which usually comes down in bright yellow form should be boiled for a while to coagulate it. It is then filtered off on a weighed Gooch crucible.

8. Wash the gold precipitate several times with hot water, then with alcohol and dry. Weigh the gold precipitate in the Gooch crucible as shown in Fig. 49. The weight of the gold over the weight of the alloy deposit determined previously, multiplied by 100 gives the percentage of gold in the deposit. The percentage divided by 4.17 gives the carat of the deposit. Thus, to take a practical example: The weight of the silver strip after plating: 2.150 grams.

The weight of the silver strip before plating: 2.050 grams.

Weight of deposit: .100 grams.

Weight of gold precipitate: .086 grams.

Per cent gold in deposit: $\frac{.086 \times 100}{.100} = 86$ per cent.

Carat of gold deposit: $\frac{86}{4.17} = 20.6$ carat.

Other metals present in the deposit may be tested for by taking aloquot parts of the filtrate after the gold filtration and testing by the methods briefly mentioned at the beginning.

Determination of Gold on a Plated Piece

Very often a simple determination of the total amount of gold plated on a piece is all that is desired. The carat of the bath is close to 24 and all the manufacturer wants to know is how much gold he is putting on the piece. In this case there are two choices open: The gold can be stripped off and the gold determined in solution or the basis metal can be dissolved out from under the gold. A third and usually more approximate method is to weigh an individual piece before and after the deposit is put on. The choice of methods is a matter of judgment. If the plated object is bulky so that it will be too time consuming and acid wasting to dissolve, it is better to strip it; if it contains tin or other substances that may cause difficulty in filtration, it is also better to strip and determine in liquid form. If, however, the plated object is small and is made of base metals that dissolve easily in nitric

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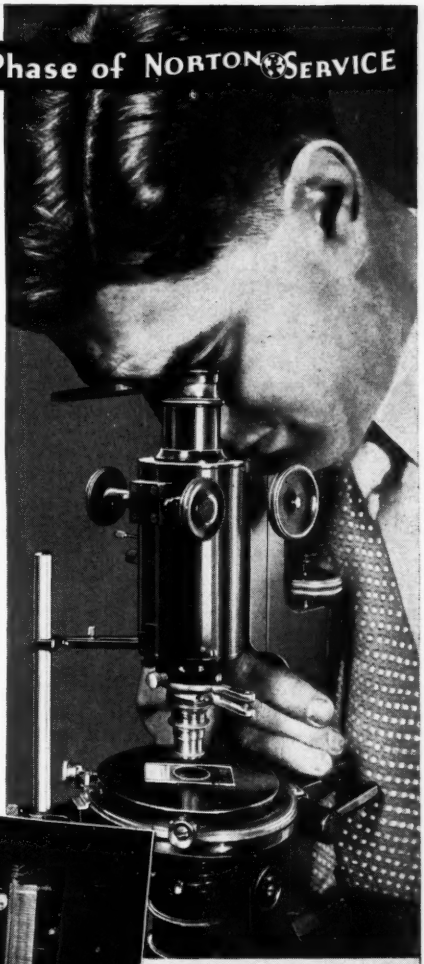

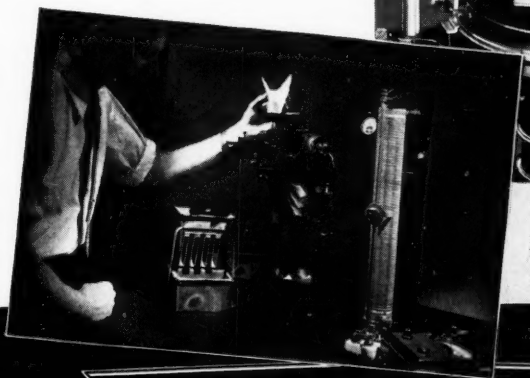

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the best method is to drop the piece into dilute or mildly concentrated nitric acid and boil to dissolve out the base metals, and the disintegrated gold plate is filtered off on a weighed Gooch crucible, washed, dried and weighed. If the carat of the gold on the particular piece is to be determined proceed as in the previous instance.

This completes our description of the analytical procedures for determining the distribution of gold in the plating room. The next installment will take up systems for controlling and governing of this distribution.

[1]Joseph B. Kushner, Metal Cleaning & Finishing, March, 1935.
[2]Haas, Joseph—Metal Industry, Vol. 18, p. 465 (1920).
[3]Kushner, Joseph B.—Industrial & Engineering Chemistry, Analytical Ed., November, 1938.

"More Than Meets the Eye." Of interest to manufacturers of metal products is a new brochure called "More Than Meets the Eye" which describes recent advances in the field of decorative and protective coatings. The brochure is being distributed by Interchemical Corporation, 75 Varick St., New York City.

The chemical coatings discussed in "More Than Meets the Eye" include printing and lithographic inks, gravure inks, industrial finishes, metal decorating materials, textile colors, pigments and raw materials, coated fabrics, and various office and artist's supplies.

It is pointed out that in many cases these coatings are related in character. Thus, fundamental research directed to problems involving one type of coating, such as printing inks, may very well have application to the problems involving other types of coatings, such as textile colors and industrial finishes. How this research has produced improved materials which make possible faster production and improve the appearance and durability of many kinds of products is covered in a picture story.

The widespread use of chemical coatings in connection with everyday living is stressed in the brochure. There are seven large color pages indicating a few of the thousands of articles we see daily which are dependent on chemical coatings for their utility or beauty. Examples are printed newspapers, books, magazines, printed containers and wrappers, decorated cans, dress goods, shirts, electric appliances, stoves, washing machines, and office supplies like carbon paper and typewriter ribbons.

A special appeal is made to manufacturers who are dissatisfied with the production speed they are obtaining at present or with the appearance or durability of their products. It is suggested that research has produced new methods and new materials which contribute materially to attaining these advantages.

Copy free upon request.

"Facts About White Paint and Better Illumination" is the name of a new brochure now being issued by The Sherwin-Williams Company, 101 Prospect Ave., N. W., Cleveland, Ohio. Containing 26 pages and made up in 8½ in. by 11 in. data-file size, the new book analyzes the effect of paint on lighting and illumination, showing by chart and by photographs how scientific plant painting contributes to efficient illumination, better working conditions, and greater output.

Also included are charts showing the coverage of various types of paint, the loss in reflection value with time, and special Spectro - Photometric comparisons of various colors and types of plant maintenance finishes. Another feature of the book is a three-page graphic specification guide which shows maintenance engineers how to prepare each surface for painting and what type of paint to use. A copy will be sent to any plant executive requesting it on his letterhead.

Bristol Product List. A mimeographed list of Bristol Products is now being issued by The Bristol Company, 66 Bride St., Waterbury, Conn. One sheet gives the various trade names used on Bristol products. A second sheet gives a brief breakdown with information concerning the bulletins and catalogs which describe the products listed. A third sheet is more extensive and gives products under headings that are quite commonly used in product listings.

A copy of this listing will be sent free upon request.

New Wrinkles in Finishing. Another issue of "New Wrinkles in Finishing," the timely sales magazine published by New Wrinkle, Inc., Mutual Home Bldg., Dayton, Ohio, is "just off the press." It contains a number of articles showing the actual application of Wrinkle Finish to nationally known products and describing in detail the results each of these manufacturers has obtained, both in improving product appearance and in reducing product finishing coats.

New Wrinkles in Finishing is published every other month and is mailed regularly to product finishers requesting a subscription on their business stationery. There is no charge.

De Bothezat Fan Selection Booklet. A booklet written in non-technical language on the subject of sound levels and other related factors governing selection of axial flow fan units is now being issued by the De Bothezat Ventilating Equipment Division of American Machine and Metals, Inc., East Moline, Illinois.

Methods of rating noise levels in decibels, comparison of various sound reference levels, influence of fan tip speeds and effect of distance on noise readings are among some of the interesting points discussed in this unbiased approach to a better understanding of the factors governing proper fan selection for specific sound level limits.

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Ideal Products Catalog. Published by Ideal Commutator Dresser Co., 1031 Park Ave., Sycamore, Ill., this 24-page illustrated catalog covers in detail Ideal Flashlight Storage Batteries, "Quick Heat" Soldering Irons, "Silent" Commercial Cleaners, Water Pickup Cleaners, Insulation Formers, Armature and Stator Holders, "Hot Blade" Wire Strippers, Lamp Changers, Grinding Wheel Dressers, "Universal" and "Thin-Line" Electric Etchers, Switch Box Supports, and numerous other products.

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A *Practical and Theoretical Explanation of Corrosion*

By WALLACE G. IMHOFF, B.A., B.S., M.S., Met. E.

President of the Wallace G. Imhoff Company, Vineland, New Jersey

SO much valuable material has already been written on the subject of corrosion that it would seem difficult to add anything really new. However, the writer is going to try to approach the subject from a practical angle, and only review the work already done when absolutely necessary to try to develop some new angle of the subject. Many other metals rust and corrode besides iron and steel, but since only iron and steel are galvanized by the hot-dip process, the discussion of rusting and corrosion will be confined almost entirely to iron and steel.

From a purely logical standpoint there can only be no corrosion under two sets of conditions which are:

1. When there is nothing that will corrode; and
2. When there are no agents of corrosion.

If there is no material that will corrode there will be no corrosion, or if there are materials that will corrode but no agents of corrosion, still there will be no corrosion.

All things, both organic and inorganic, corrode and are eventually destroyed. This is the operation of the great "Principle of Destruction" which is the source of materials of new supply, since the total amount of everything is always the same. But it might be argued wood and stone, though not as strong, are much better able to withstand atmospheric influences. This is not so, however, but rather due to the fact that the average person is not familiar with the corrosion and destruction of rocks. A typical example is the corrosion and destruction of the basic igneous rocks in the tropical regions. The limonites (iron oxide) of northern Cuba, constituting the weathered mantle of serpentine rock, are enormous in tonnage.

This brings up the question as to what is the natural state of things. The answer to this is their simplest form, for that is the stable form. To get in that form the more complex arrangements have to be broken down, de-energized, simplified, and reduced to the state of stability. The last state may not even then be the simplest form, as a great amount of additional energy may still have to be supplied to break up the combination into its component parts. A

typical example is silica, ordinary sand, which is stable and in a simple form, yet not reduced to the last stage of separation of its components. Sand is stable because it is an oxide, and corrosion is oxidation and is usually accompanied by hydration.

The result of the corrosion of iron and steel is rust, and therefore corrosion is rusting, since the process is continuous until the iron or steel has been completely destroyed. The process of changing the iron from iron to rust is, therefore, corrosion, and the result of the action is rust. This, however, assumes that we know what rust is, and that we also understand the process of corrosion, neither one of which seems to be definitely settled.

According to one authority, rust is hydrous ferric oxide; Fe_2O_3; another states rust is Fe_2O_3, x H_2O; still another states, "When commercial iron is exposed to a humid atmosphere for a short time, it soon becomes covered with a reddish-brown film which is called rust. Iron rust seems to be an indefinite mixture which on analysis furnishes numbers which vary according to the age of the rust. Rust usually contains ferrous oxide, ferric oxide, carbon dioxide, and water. Analyses shows that rust is probably a mixture of ferric oxide, hydrated ferrous and ferric oxides, and basic ferrous and ferric carbonates. If the rust has been long exposed to the air, the amount of ferric oxide is relatively large, and the amounts of ferrous oxide and carbon dioxide are small. Rusting is a complex process, and workers are by no means agreed on the simple facts." One authority gives red rust the chemical formula $Fe_2O_3 \cdot 3H_2O$. This immediately brings up the question of different colored rusts. Still another represents rust as follows: $3\,Fe_2O_3 \cdot$

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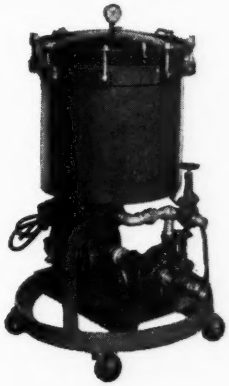

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H_2O. In discussing this same subject, another authority says, "Rust — ferrous hydroxide, FeO_2H_2, is soluble in water and its formation and solution is the first step in the production of rust. Because of its solubility, however, it does not ordinarily make its presence known until a further reaction occurs:

$$2\ FeO_2H_2 + H_2O + O = 2\ FeO_3H_3$$

The rust, FeO_3H_3, so formed precipitates from solution."

Enough examples have been cited to show that even authorities on the subject are divided as to just what rust is. The fact is all of them are right, as rust is not one iron oxide, but a whole series of oxides and hydroxides of iron as will be explained; a series which is a part of one continuous series of iron oxides starting on the one end with iron oxide formed at a high temperature, in the presence of excess oxygen, with no water of any kind present; and extending to the other extreme of iron oxide formed at a low temperature in the presence of excess oxygen and excess water. The iron molecule is, therefore, capable of taking on many colors. With increased oxidation at high temperatures the color is a deep blue; with decreasing temperature, cooling, water, and decreasing oxidation, and excess iron, the color is black; with increasing temperature in a reducing atmosphere the color is brick red; at low temperatures, large excess of water, slow oxidation the color is yellow. In liquid solutions, under reducing conditions, the color is deep green.

Enough examples have been given

TABLE I

Increase Water ↓ Decrease
Decrease Temperature ↓ Increase

Oxidizing Conditions		Reducing Conditions	
Color	Remarks	Color	Remarks
Bright yellow	Excess water, iron in streams	Deep green	Excess water, example in pickle solution
Tan yellow	Medium water	Grass green	Lean green blast furnace slags
Brown	Little water		
Brown red	No water—some heat		
Purple red	Low temperature	Brick red	No water; furnace, medium temperature, oil, reducing atmosphere
Deep blue	Medium temperature, oxidation		
Bright blue	High temperature, excess oxidation	Metallic iron	Temperature high enough to reduce red oxide

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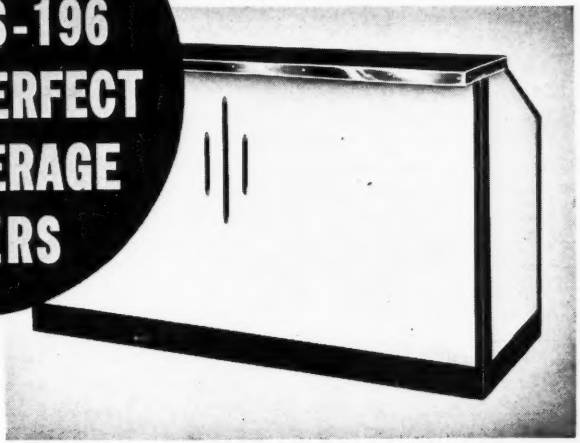

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to show how complicated the situation is and about all that can be done here is to point the way for more accurate investigators to follow up with detailed research investigations, accompanied by accurate chemical analyses. A rough, crude, attempt will be made to organize the knowledge in a practical way so that the way will be clear. Table I shows the various colors that iron assumes under different conditions.

Table I refers to the condition of iron under oxidizing and reducing conditions from liquid water solutions, through conditions of no water, and then into conditions of increasing temperatures such as are found in furnaces. The conditions represent decreasing water, increasing temperature, and increasing oxidation. The conditions are going up the scale of temperature. When the process is reversed, the temperature going down, oxidation decreasing in intensity, and these rising conditions being extinguished, then the color of the iron is black. Roll scale and black blast furnace slags illustrate this black iron condition.

It is to be noted that the rust series of iron oxides is found on the oxidizing side. Since the upper part of the series is one in which water and oxidizing conditions are prominent, an effort will be made to increase the detail of this part, since it is this part which makes up the rust series. Table II indicates the conditions of formation of the rust.

It is necessary to offer a word of explanation in regard to this practical table of rusts. In considering the kind of rust, loose, bright yellow rust is found in the bottom of stream beds and mines. In traveling from Pittsburgh to Wheeling, W. Va., passing through the coal mining towns, the streams are yellow with rust. These conditions are conditions of iron either partially or wholly submersed in running water, and freely exposed to the open air. Then there is what might be called the intermediate stage where iron is left out exposed to the weather where it is intermittently rained on and then dried, in the open air. Then there is the stage of dampness with only occasionally moisture,

(Photo Courtesy The B. F. Goodrich Co.)

This illustration shows a welded metal tank used by the chemical and allied industries in which a rubber lining is being placed.

which gives the dark brown to brown red, sandy rust. Finally, there is the iron that has been subject to these conditions but under new conditions it is absolutely dry. The rusting processes are completed and the iron has been completely destroyed. Only the grainy, sandy iron oxide remains.

The texture of rust is self explanatory and most people are familiar with all of them. The conditions of complete submersion in water in streams to conditions of almost no water at all are also recognized. The matter of oxidation may not have been so impressed, as not many are able to recognize the various stages of oxidation from a practical standpoint. The speed of oxidation will naturally be slow as compared to the quick burning up of iron (oxidation) at the high temperatures of industrial furnaces. In water it is slow because the action gets its supply of oxygen from the water. There are both air (oxygen) and water present, but the temperature is low, and, therefore, the action is slow. As the water decreases the speed of the process is slowed down until with no water it stops. There is not a wide difference in temperature. Mine waters would be the coldest, being possibly 40 to 50 degrees F., while when the action takes place in the open air the temperature may rise to 100 degrees F.

In attempting to represent what goes on the chemical formula of the first rust is shown with (z) H_2O, which signifies an excess such as would be found in complete submersion. As the water decreases, it is represented by letters of the alphabet nearer the beginning. In the first rust compounds the water is both free and chemically combined water. As the series passes nearer to the dry rust end, the free uncombined water decreases. Finally only the combined

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TABLE II

Kind	Consistency	Water	Conditions of Oxidation	Speed of Oxidation	Temperature	Chemical Formula
1—Bright yellow	Loose	Excess, streams	Good	Slow	Low, mine water, etc.	$Fe_2O_3.zH_2O$
2—Yellow	Loose to grainy	Excess water	Good	Slow	Low, streams, etc.	$Fe_2O_3.tH_2O$
3—Orange	Grainy	Plenty	Good		Low, water	$Fe_2O_3.pH_2O$
4—Light brown	Grainy	Decreasing	Slower	Slow Slower	Higher, less water	$Fe_2O_3.lH_2O$
5—Brown	Sandy	"	"	"	Higher	$Fe_2O_3.iH_2O$
6—Dark brown	Very sandy	"	"	"	"	$Fe_2O_3.gH_2O$
7—Very dark brown	Platey sandy	"	"	"	"	$Fe_2O_3.eH_2O$
8—Dry pitting	Large plates	Little	Very slow	Very slow	Warm	$Fe_2O_3.cH_2O$
9—Very dry	Plates	Chemically combined	Practically stopped	Extremely slow	"	$Fe_2O_3.bH_2O$
10—Rust	Iron oxide grainy	None	Completed	Stopped	"	Fe_2O_3

water of crystallization remains and at last even this is gone. This represents the last stage of the rust series, or iron oxides in air under oxidizing conditions with increasing water conditions.

The next stage of iron oxides is the heating stage above atmospheric temperatures. Since this is done in furnaces, then the conditions may be either in a reducing atmosphere in the furnace or an oxidizing atmosphere. In the reducing atmosphere the last traces of free water, and water of chemical combination disappear, and the iron gradually assumes a brick red color. These oxides are formed in a reducing atmosphere, and if the temperature is high enough, the iron will be reduced to the metallic state.

The stable form of iron as we know it is iron oxide. All iron and steel tend to rust and corrode and go

back to this condition. Whether the iron is in the form of a carbonate, hydoxide, or oxide depend upon the conditions present. For example, the basis of the iron ores is ferruginous chert and ferrous carbonate. At the time these enormous deposits were laid down the normal conditions of stability were such that large quantities of carbon in the decaying form were present. The stable state at that time, therefore, was the carbonate. If a piece of iron is placed in water and left there after some time a flocculant red brown precipitate will appear. This is ferric hydroxide, and under these conditions of excess water that is the stable state. If a large amount of this red brown precipitate is collected and removed from the water and dried it assumes another state. In the air it turns to the familiar rust, as under those conditions that is the stable state. The statement, "All roads lead to Rome," is an example of the various means and conditions that all lead to the final stage of rust. It is only a question of which road. The atmosphere of today is about one-fifth oxygen, so that the stable state of iron today in the air must be in the oxide form. Carbonates, hydroxides, etc., are only temporary forms that exist as long as conditions are such as to allow them to exist. Atmospheric conditions are the strongest, and everything tends to revert to its stable form under ordinary atmospheric conditions. The practical series did not include carbonates and hydroxides, as the subject is already complicated enough without trying to cover too much at one time. With the water and oxidizing series clear and systematized, it can be readily seen the carbonates and hydroxides are only another route to the same destination. This discussion for the present answers the question, "What is rust?" It is any of these

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compounds, and may be a number of them at the same time depending upon whether the conditions are stable, or are changing from one set to another.

The next question is "What is corrosion?" This question is even harder than the first one to properly answer. Before answering it, another one should be answered first, namely, "What are the agents of corrosion?"

The agents of corrosion are air, which contains almost 21 per cent oxygen, water, moisture, ice, carbon dioxide, sulphur gases, chemical solutions, etc. The most common kind of corrosion with which most everyone is familiar is atmospheric corrosion. However, pipes and other steel articles are buried under ground for various reasons and purposes and they are subjected to different conditions. Then there are articles entirely submersed in water, other materials that are used around chemical plants, etc., and still others that are subjected to the action of stray currents from various places where there is electricity in large quantities. Atmospheric corrosion is characterized by a large excess of free available oxygen; underwater corrosion is characterized by less available oxygen, but often more acid or alkaline conditions; and chemical corrosion is characterized by the presence of large quantities of acids and acid vapors, or alkaline solutions and vapors. Where there are stray currents corrosion is accelerated and goes on at a faster rate than natural corrosion.

The causes and agents of corrosion, however, may be classified into two distinct classes from a logical and practical standpoint, namely, those which are due to the physical or chemical properties of the material itself, and those due to the affect of the actions of agents entirely independent of the material corroded. In considering those causes within the material itself, in iron and steel there are such factors as density and porosity; chemical state of the iron, whether free or combined with carbon, sulphur, phosphorous, etc., differences of chemical composition due to metallic inclusions, segregation of metalloids, etc., inclusions of iron and other non-metallic oxides; internal stresses and strains of various kinds and intensities, besides the effect of gases and foreign substances that may be caught and held in the material.

Again returning to the logic of the situation—if chemical analyses show that rust is largely hydrated iron oxide, then it is logical to conclude that both water and oxygen are essential to corrosion. Many competent authorities on the subject have already proved that iron will not corrode in the absence of moisture, and that oxygen accelerates corrosion. To form an oxide, oxidation must take place in some form or other, and the fact investigators have conclusively proved that iron does not corrode in pure water if no air is present, is another proof that oxygen must be present to form rust.

The question, "What are the agents of corrosion?" having been answered, we are now ready to return to the original question, "What is corrosion?" The result of corrosion is rust, so by logic corrosion is the process that forms rust. The point of vital interest is, how does it do it?

This question cannot be answered in a practical way, or perhaps it would be better to say in a simple way. We must resort to theory and the vast amount of work done by others to show just how corrosion takes place.

There are at present two theories as to the cause of corrosion, the chemical theory supported by Cush-

man, Gardner and others, and the electrolytic theory as formulated in 1903 by Dr. Whitney. Yet up to the present time the exact causes of corrosion do not seem to be known. Before offering any further explanation, it seems in place to state the general outline of these two other theories.

In the chemical theory water, air, and an acid are necessary to explain the process of corrosion. The air contains water and various gases. The principal constituents of the atmosphere are listed below:

	By weight	By volume
Oxygen	23.024	20.941
Nitrogen	75.539	78.122
Argon	1.437	.937
	100.000	100.000

With the argon occur rare gases whose proportions Ramsay estimates as follows:

	Per cent by volume
Krypton	0.028
Xenon	.005
Helium	.0004
Neon	.00123

These gases, with argon are absolutely inert; and as they seem to have little geological or other significance here, they need not be further considered.

In addition to the elements above, ordinary air contains in varying quantities, aquous vapor, hydrogen dioxide, ozone, carbon dioxide, ammonia and other compounds of nitrogen, sometimes sulphur, traces of hydrogen, organic matter, and suspended solids; and among these agents some of the most active agents of corrosion are found. In a rough way the air consists of four-fifths nitrogen and one-fifth oxygen.

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(1) H_2O + CO_2 = H_2CO_3
Water — Carbon Dioxide — Carbonic Acid

This acid then attacks the iron forming iron carbonate and hydrogen according to the following reaction:

(2) 2 Fe + 2 H_2CO_3 =
Iron — Carbonic Acid
2 $FeCO_3$ + $2H_2$
Iron Carbonate — Hydrogen

The soluble iron carbonate is then hydrated and oxidized to the insoluble iron hydroxide as follows:

(3) 2 $FeCO_3$ + 5 H_2O + O =
Iron Carbonate — Water — Oxygen
2 Fe $(OH)_3$ + 2 H_2CO_3
Iron Hydroxide — Carbonic Acid

The insoluble iron hydroxide then looses part of its water and changes to iron oxide, or rust as follows:

(4) 2 Fe $(OH)_3$ = $Fe_2O_3 \cdot 3\ H_2O$
Iron Hydroxide — Iron oxide (Rust)

This theory would also include the action of sulphur gases, and other gases that would form an acid and exert a chemical process similar to the one given with carbon dioxide. Many experiments have been made by Cushman and Gardner to support this theory of rusting.

The electrolytic theory of corrosion was suggested by Dr. Whitney. This theory seems to be a more popular one as it offers a better explanation for the many observations that have been made on corrosion. Water and air are necessary in this theory, but not necessarily carbon dioxide or other gases. Many experiments have shown that different metals go into solution at different rates. Sodium and potassium dissolve readily, while others like chromium, are not so readily corroded. The electrolytic theory takes into account the "ion," and electricity. It is based on the fact that when acids, alkalies, and salts are dissolved in water, they break down and form what are known as "ions." As an example hydrochloric acid dissociates into positive hydrogen ions and negative chlorine ions.

In explaining rusting by the electrolytic theory water and oxygen are present. The water forms free hydrogen ions and also hydroxyl ions. The ions of iron unite with the free hydroxyl ions forming iron hydroxide. When the hydrogen ions are deposited and the iron goes into solution there is an exchange of electric charges carried by the ions, such that the hydrogen is set free in the form of gas particles and at the same time electrical balance is obtained by the uniting of the iron and hydroxyl ions. The chamical reactions representing these changes may be shown as follows:

2 H_2O = 2 (OH) + 2 H
2 parts water — 2 Hydroxyl ions — 2 Hydrogen ions

This shows the dissociation of water into hydrogen and hydroxyl ions. Iron hydroxide is then formed with the liberation of hydrogen gas according to the equation:

Fe + 2 (OH) + 2 H =
Iron — 2 Hydroxyl ions — 2 Hydrogen ions
$Fe(OH)_2$ + H_2
Iron Hydroxide — Hydrogen Gas

The iron hydroxide formed is white, but further oxidation changes it to the red hydroxide, which is the same hydroxide as is formed in the chemical theory. The equation for this change is shown below:

2 $Fe(OH)_2$ + O =
White iron hydroxide — Oxygen
H_2O + 2 $Fe(OH)_3$
Water — Brown iron hydroxide

This brown iron hydroxide is also changed to iron oxide by loss of water

as was shown in the chemical theory. Both theories thus give an end product of iron oxide, or red rust.

There are a few things that have been conclusively proved by the many authorities investigating corrosion. Among the most important features are:

1. Iron will not rust in the absence of moisture.
2. Iron will not rust in pure, gas-free water.
3. Iron will rust in gas free, pure water when a stream of oxygen is run into it.
4. Oxygen accelerates corrosion, and is essential to it.
5. Rusting will not take place in gas-free, pure water when carbon dioxide is run into it.
6. Iron in gas-free pure water will rust when both carbon dioxide and oxygen are run into it.
7. Acids accelerate corrosion.
8. Corrosion in water is proportional to the dissolved oxygen present.

The writer will now try to do two things—first, show clearly what corrosion is and how it takes place, that is, the mechanism through which it operates; and second, that the Chemical Theory and the Electrolytic Theory are one and the same theory.

It is a fact which does not have to be proved that rusting takes place in the open air where there is rain and moisture present. This immediately furnishes three base materials, iron, water, and oxygen (the latter in the air). The mechanism of destruction, however, is so complicated that it is necessary to discuss some of the fundamentals of chemistry. In order to make the explanation clear, the simplest known facts will be first stated and then little by little added to, and built on until the whole process has been clearly demonstrated.

The first discussion will take up the element hydrogen. Methane, CH_4, is a gas containing four parts of hydrogen. It has been called "Marsh Gas" because it is found in stagnant, marshy pools. It may easily be collected from such pools. The hydrogen therefore is not combined with the water, and this compound could in no way be considered an acid. Hydrogen enters into chemical combination to form almost countless chemical compounds which are not acids. There are between 250 and 300 compounds of carbon and hydrogen alone in the hydrocarbon series which include such materials as turpentine, benzene, and so on. These compounds are not acids and still they contain hydrogen.

A better known chemical compound is hydrogen chloride, HCl, which when the gas is passed through water forms the common muriatic acid with which most galvanizers are familiar. In the form of the gas, HCl, hydro-

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gen chloride, will not attack and dissolve metals; neither is there any action upon blue litmus. This compound therefore like methane is not an acid. However, when this compound which is not an acid, is passed through water and a solution is made with the gas, the resulting product is an acid, and possesses what have been called "acidic properties." This immediately then brings up the question, "What IS an acid?"

To clearly explain what an acid is we must turn to what has been called the "Ionic Hypothesis." The basic facts of this hypothesis are:

1. Electrolytes in solution conduct electricity, and the process of electrical conduction is attended by a splitting of the molecules of the solute into anions and cations; the anions appear at the anode, and the cations at the cathode. The separation of a certain number of anions at the anode is simultaneously attended by the separation of a chemically or electrically equivalent number of cations at the cathode. During electrolysis, the anions and cations appear to be discharged electrically, because electrically neutral molecules appear as secondary products of the electrolysis.

2. The anion which separates at the anode is not necessarily derived from the same molecule as the cation which appears at the cathode.

3. Solvent and solute together make a conducting medium, since as a rule neither solvent nor solute alone shows a marked capacity for conducting electricity.

4. No measurable time is needed to put an aqueous solution in a condition to conduct the current. Immediately the necessary difference of potential appears at the electrodes the process of electrolysis begins.

5. Osmotic pressure and related phenomena show that electrolytes in dilute solution have what seems to be molecular weight, which suggests that the "ordinary" molecule of the electrolyte dissolved in certain solvents is dissociated into two parts.

There are many terms here that need to be explained to the average practical galvanizer. The process of decomposition or analysis by the aid of the electric current is called electrolysis. The liquid which is decomposed is called the electrolyte. When the conducting medium is not decomposed by the current it is called a non-electrolyte. The plate at which the metal collects is called the cathode from the Greek word, "kata" (down), and the Greek word "hodos," a path. The plate about which the acid collects is called the "anode," from the Greek word "ana," up, and the Greek word, "hodos," path. The anode and cathode are called the electrodes. Electrodes are doorways for current passing in and out of the decomposing body. The current first splits up the decomposing liquid into two parts. The anions (from the Greek word, traveler) go to the anode, and the cations go to the cathode. Ions are atoms, or groups of atoms which carry a positive or negative charge of electricity, and they are formed by the dissociation of the electrolyte in the solution. Each molecule, on dissociation, furnishes two kinds of ions with equal and opposite charges of electricity.

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All substances do not ionize to the same degree. The degree of ironization is equal to the number of molecules ironized divided by the total number of molecules. The degree of ionization of some of the common acids is shown below:

Acid	Fraction Ionized
HNO_3 62%	0.096
HNO_3 Dilute	0.820
H_2SO_4 Dilute	0.510
Carbonic Acid 1/10 N	0.002

All acids when dissolved in water furnish hydrogen ions. The properties of acids are therefore due to the presence of H ions, and this fact linked with the fact that all acids dissociate with the formation of hydrogen ions, illustrates that in reality there is only one acid, and that is the hydrogen ion. In this fact we show that the chemical theory and the electrolytic theory for corrosion are the same. A little further discussion will serve to show that the hydrogen ion is the mechanism of operation of both of them.

(Further discussion on this intensely interesting subject will be continued in the August issue.)

Thor Contractor and Mining Tool Catalog No. 42. A 64-page catalog describing a complete line of Thor Mining and Contractors Air-Powered Tools has been issued by the Independent Pneumatic Tool Co., 600 W. Jackson Blvd., Chicago, Ill. The catalog contains complete descriptions and specifications of all Thor Rock Drills, Paving Breakers, Clay and Trench Diggers, Sump Pumps, Saws, and associated air tools. In addition, it graphically depicts specific applications for all the various tools.

Profusely illustrated and attractively printed in two colors, the catalog also gives detailed information on accessories and equipment for use with the tools and points out important construction features. Copy free upon request.

DeVilbiss Spray Finishing Equipment Catalog. The DeVilbiss Company, 300 Phillips Ave., Toledo, Ohio, has recently issued a new catalog covering, in condensed form, its complete line of standard spray-finishing equipment for industrial use.

The new catalog, called the "IE," replaces catalog "ID-A," and brings all prices and specifications of the company's industrial line up to date.

Copies of catalog "IE" may be secured by writing to the company.

Standard Electrical Tool Catalog No. 43. Electric grinders, buffers, drills, and so on, are described in detail and attractively illustrated in a 36-page catalog, designated as the No. 43, which is now being distributed by The Standard Electrical Tool Co., 1941 W. 8th St., Cincinnati, Ohio.

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News OF THE INDUSTRY

New President of N. Y. Paint, Varnish and Lacquer Association

Leo Roon, founder and president of Roxalin Flexible Lacquer Company, Inc., Elizabeth, N. J., was recently

Leo Roon

elected president of the New York Paint, Varnish and Lacquer Association.

Central District Enamelers' Club Meeting

The third meeting of the 1941 season of the Central District Enamelers' Club held recently at the Allerton Hotel, Cleveland, has gone into the records as one of the most successful and interesting meetings yet held, with an excess of 135 in attendance.

The plant trip through the Ferro Enamel Corporation plant showing feldspar and clay processing, the smelting of frit, and the manufacture of color oxides, as well as the numerous testing and control laboratories, proved to be of great interest to those making the trip.

The highlight of the meeting was the timely and instilling talk on "Industrial Defense," by Bennett Chapple, assistant to the president of the American Rolling Mill Company, and the "Ironmaster" on the Armco radio programs of a short time ago. Mr. Chapple ably discussed many of our present day problems dealing with defense and the future of our great country.

W. J. Stoddard Appointed Pennsalt Representative

Newest technical sales representative of the Pennsalt Cleaner Division of the Pennsylvania Salt Manufacturing Company, 1000 Widener Bldg., Philadelphia, Pa., is Willis J. Stoddard. Mr. Stoddard takes over the territory including Columbus, Cincinnati, Dayton, and Indianapolis, with his headquarters at Dayton.

Mr. Stoddard, whose education includes a course in chemical engineering at the University of Detroit and quantative analysis at Wayne University, brings to his territory the benefits of 12 years' experience in the production end of his company's business and in the

chemical laboratory at Wyandotte.

This addition to the Pennsylvania Salt Manufacturing Company's technical sales force is necessitated by the tremendous increase in business in that section of the country.

Kushner to Occupy Larger Quarters

Mr. Joseph B. Kushner, metal finishing consultant and engineer, has moved his offices and laboratories from 126 W. 32nd St. to newer and larger quarters at 114 E. 32nd St., New York City. From his completely equipped laboratory on the thirteenth floor, Mr. Kushner will continue to handle the problems of the trade, paying particular interest to problems in metal coloring and precious metal plating as well as to research and development in the general plating field.

Mr. Kushner is at the present moment developing a new process which he declares will be of great interest to the plating industry. He hopes to be able to have it on the market by early fall of this year.

James R. White to Direct Sales of Clover Mfg. Co.

Clover Mfg. Co., Main St., Norwalk, Conn., manufacturer of coated abrasives and lapping compounds, announces the appointment of James R. White as director of sales.

For the past three years, Mr. White has been the president of Rickard and Company, Inc., New York City, industrial advertising agency, which position he resigned to become associated with the Clover Mfg. Co. For several years prior, he was vice-president and director of sales and promotion of Jenkins Bros., valve manufacturers, Bridgeport, Conn.

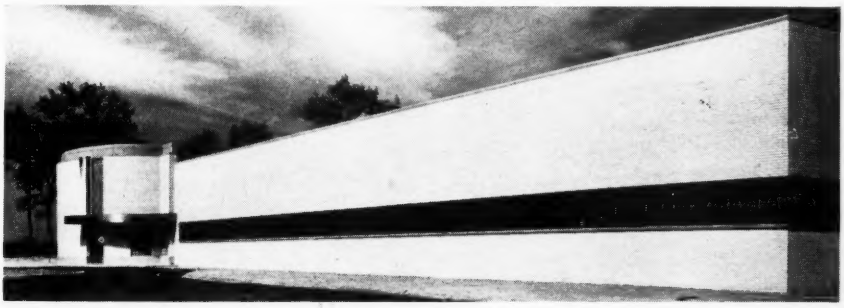
James R. White

He is past president of the Technical Publicity Association of New York City, and at present is a member of the executive board of the Army Ordnance Association.

New Home of Industrial Tape Corporation

The Industrial Tape Corporation, New Brunswick, N. J., recently completed the factory building shown in the accompanying illustration. This ultramodern structure has been appropriately named "The Factory of Tomorrow."

This building is constructed with con-



New Home of Industrial Tape Corporation

crete foundations and floor, the side and rear walls being faced with Natco tile. Fluorescent lighting is employed throughout. The building occupies approximately 58,456 sq. ft. of working space.

The products of the Industrial Tape Corporation include four types: cloth-backed tapes, paper-backed tapes, cellophane tapes, and specialty tapes.

Pumice Corporation of America Formed

The Barnsdall Oil Company, through its subsidiary, Barnsdall Tripoli Company, has sold to the McAleer Manufacturing Company, Detroit, Mich., and Whittaker, Clark & Daniels, Inc., manufacturer of minerals, colors and pigments, New York City, its pumice mill at Grants, N. Mex., and has leased to them a large pumice deposit eight miles from Grants which will supply the mill with raw material. This is a particularly significant transaction due to the fact that the bulk of fine pumice has always been imported from the Italian island of Lipari, and this particular deposit in New Mexico, discovered and developed by the Barnsdall Oil Company, will be able to supply the American market with the finest quality of product of its kind in the world.

The new company will be known as Pumice Corporation of America, a Delaware corporation; and whereas the ownership has been transferred to the McAleer Manufacturing Company and Whittaker, Clark & Daniels, the entire operating staff and policies of the company will remain unchanged.

Clarence E. Clark, of New York, has been elected president; N. Bradley Higbie, Jr., of Detroit, vice-president; John N. Ebert, of Grants, vice-president and general manager; Carlton M. Higbie, of Detroit, treasurer; and Harold G. Robinson, of New York, secretary.

Handy & Harman Announce Organization Changes

At the recent organization meeting of the directors of Handy & Harman, the following officers were re-elected: Cortlandt W. Handy, chairman; G. H. Niemeyer, president; R. H. Leach, vice-president; H. W. Boynton, treasurer; H. W. Spaulding, secretary. Judson C. Travis continues as assistant to the president; R. F. Drew, manager Providence plant; F. L. Spies, manager New York plant. F. C. Jones, formerly assistant to J. C. Travis, was appointed manager of the Bridgeport, Conn., plant. J. L. Christie was appointed metallurgical manager. J. W. Colgan, manager of the Toronto, Canada, plant (subsidiary) will become sales manager of the parent company.

At the organization meeting of Handy & Harman of Canada, Ltd., held the same day, the following officers were re-elected: G. H. Niemeyer, president; R. H. Leach, vice-president; H. W. Spaulding, secretary-treasurer. Thomas H. Gallagher, formerly in charge of the Chicago Sales Office of the parent company, was appointed assistant treasurer of the corporation and manager of the Toronto, Canada, plant.

Heatbath New Miniature Freight Car Used in Promotion

The Heatbath Corporation, P. O. Box 78, Springfield, Mass., is now using a novel means to acknowledge carload orders of their Pentrate material. Upon the receipt of an order for a carload of Pentrate material, this company sends the customer a miniature freight car as shown in the accompanying illustration.

The Heatbath Corporation is also

Pentrate Miniature Freight Car

supplying free to anyone who wishes one a "Body Kit" from which a miniature freight car can be constructed.

Ernest M. Hommel to Direct The O. Hommel Co.

At the annual meeting of the directors of The O. Hommel Company, ceramic supplier, Pittsburgh, Pa., Ernest M. Hommel was elected to the presidency of that company to fill the vacancy occasioned by the death of his father, Oscar Hommel.

Ernest M. Hommel

Mr. Ernest Hommel has been actively associated with the concern he heads for the last 18 years as a sales representative, and since 1929 has been vice-president.

Organization Changes Announced by Tolhurst

Wayne Mendell, general sales manager, American Machine and Metals, Inc., East Moline, Ill., has announced important changes in the personnel of the Tolhurst Centrifugal Division.

Howard H. Harlan, sales engineer and recently manager of the New York office of Tolhurst, has been appointed technical assistant to the general sales manager, with offices in Washington, D. C., where he will maintain contact with federal government offices. Mr. Harlan will also visit the factory at East Moline periodically as technical advisor to the sales department.

George P. Hebard, formerly advertising manager, U. S. Hoffman Machinery Corporation, district manager for Fletcher Works, Inc., and recently sales and advertising manager of G. H. Bishop Company, has been made field sales promotion manager.

J. A. McCoy to Represent Logan Engineering Company

The Logan Engineering Company, 4905 Lawrence Ave., Chicago, Ill., maker of Aridifier air cleaners, has announced that J. A. McCoy, 1436 41st Place, Des Moines, Iowa, is now representing the company in the state of Iowa.

Mr. McCoy, an old-timer in engineering selling, has been serving Iowa industrials for more than 20 years with recognized lines of industrial equipment and is well known in metal working plants.

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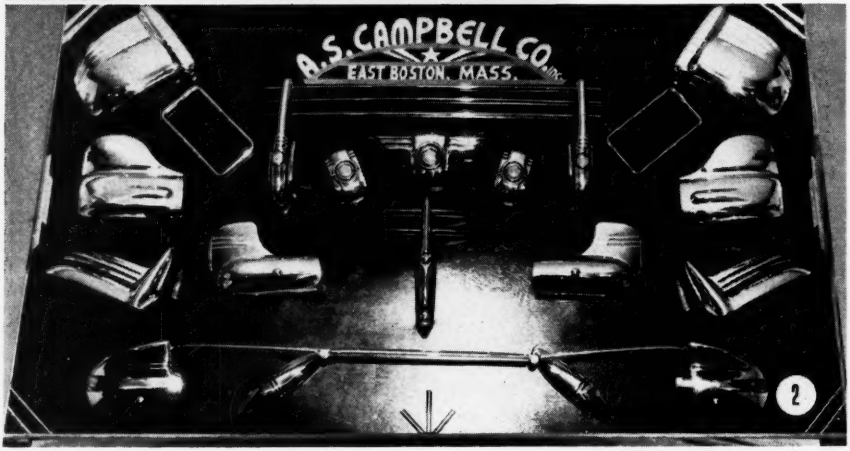
A.E.S. *Convention* Exhibits

1

Shown on this and the following page are several views of exhibits which were on display at the 29th Annual American Electroplaters' Society Convention held during the week of June 9th at the Hotel Statler, Boston, Mass. (1) First prize exhibit, submitted by Chicago Chapter. (2) Portion of Boston Chapter exhibit. (3) Exhibit sponsored by Detroit Chapter. (4) Detroit Chapter exhibit. (5) Cincinnati Chapter exhibit.



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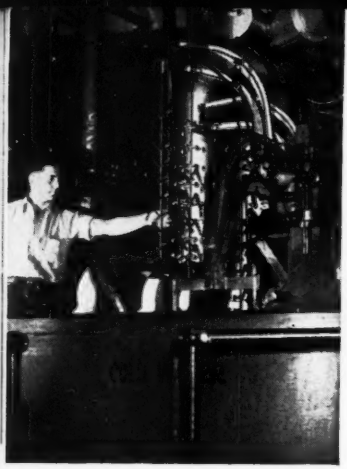


New PLANT EQUIPMENT AND Materials

Miccroplastic

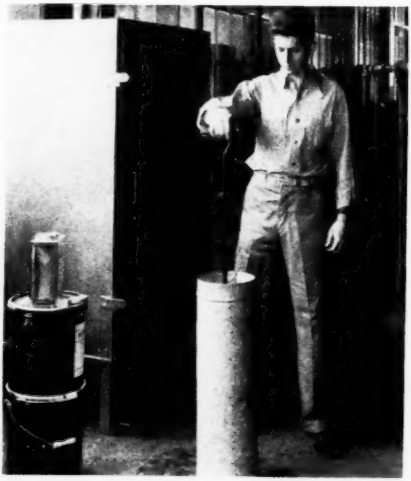
A new protective coating material known as "Miccroplastic" has just been introduced by the Michigan Chrome & Chemical Co., 6340 E. Jefferson Ave., Detroit, Mich. This new material, which provides chemical resistance to all acids and plating solutions, alkali cleaners and petroleum spirits, has characteristics which are said to have never before been offered in similar products.

One of the most important features of Miccroplastic is its exceptional adhesion to every portion of any metallic surface it covers, regardless of the shape or size of the plating rack, anodizing rack or other object which is coated. Even when portions of the coating are removed, there is no possibility that the solution will creep behind the coating. For this reason, the possibilities of contamination of baths by chromic acid which might be trapped under the coating are eliminated. With this protective coating material, it is always safe to go from bright nickel to chrome without reracking the work.

Miccroplastic provides the flexibility of soft rubber. It will not crack. Even when contact wires are flexed or when the entire rack is twisted and bent, the coating surface remains intact. The material is very free-flowing. It is dipped easily—one dip requiring as little as five seconds for submersion and immersion. Because of this quality, Miccroplastic follows every contour and never produces webbing, bridging, or air pockets.

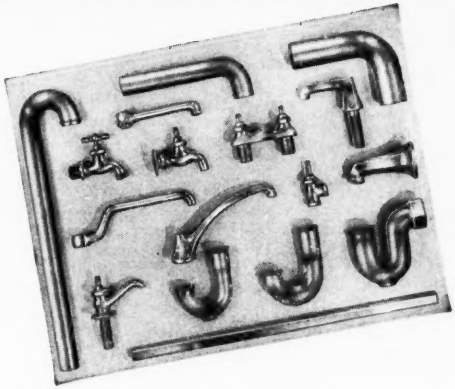
Other important features are that it contains high solids; it dries to a high gloss which makes a rinsing between baths extremely easy; and it is an excellent and permanent coating for hard chromium plating racks.

Application of the material is very simple and the only equipment required is a small, inexpensive dipping tank and a baking oven. The coating is applied directly on the metal surface which must be thoroughly cleaned. Dipping is



This illustration shows the dipping method, how the racks are hung for air-drying, a typical baking oven, and the containers in which Miccroplastic is supplied.

PLUMBERS BRASS GOODS



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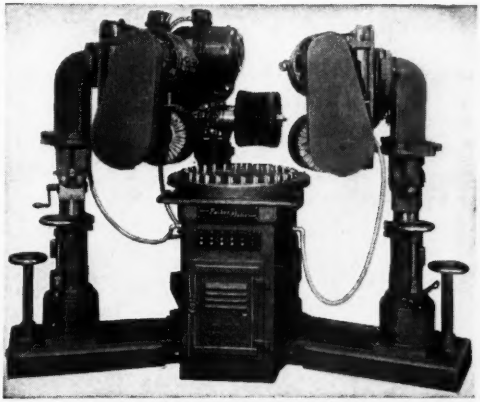

No. 424 CONTINUOUS ROTARY TYPE

•AUTOMATIC POLISHING & BUFFING MACHINES

Packer-Matic

THE PACKER MACHINE CO., MERIDEN, CONN., U. S. A.

by hand. Mechanical dipping equipment is not necessary. After quick submersion and immersion, racks are allowed to air dry for about half an hour and are then baked for one hour at 225 deg. F. Seven coats per rack are recommended.

Weldon Roberts "Brightboy" Discs, Lathe Wheels, and Tablets

Weldon Roberts Rubber Co., Newark, N. J., is now marketing a line of "Brightboy" Discs, Lathe Wheels, and Tablets for finishing, pre-finishing, polishing, and pre - polishing metals. Brightboy is a rubber-eraser compound impregnated with abrasive. The soft rubber binder cushions the abrasive and gives to Brightboy a utility which lies between that of a light grinding wheel and a buff. In operation, the abrasive recedes into the resilient rubber, falling free as the binder is worn away. The light abrasive action produces a smooth, polished or pre-polished surface.

On most metals, minor blemishes can be erased by the application of Brightboy in one of its various forms. Bright-

Weldon Roberts "Brightboy" Discs, Lathe Wheels, and Tablets

boy removes oxide film from aluminum alloys prior to welding, smooths away burrs and rough edges on die stampings, or produces a mirror finish on hard steel dies. It is also said to restore a No. 4 finish to stainless steel at soldered or welded joints. In addition, Brightboy cleans and polishes edged tools. In precision work, it is said to function with minimum dimensional loss to material.

Because the binder is soft rubber, no special tools are required to dress a Brightboy wheel, and any desired surface can be formed for special use. A worn-out tool or even an old file is said to serve as a means for facing a Brightboy wheel for use on concave, convex, or stepped surfaces.

Hygrade Miralume F-235

Designed to provide large quantities of light to aid working efficiency in industrial plants, the Hygrade Miralume F-235 shown in the illustration has been placed on the market by the Hygrade Sylvania Corp., Ipswich, Mass. The unit is supplied complete with two 100-watt fluorescent lamps and has a lumen output of over 8400, thus permitting wide spacing of units as well as making the Miralume ideal for mounting near the ceiling in high-studded areas.

The reflector of the unit is easily demountable. It is drawn from a single piece of 20 U.S. gauge metal and has a smooth, porcelain enameled, highly efficient reflecting surface. Working parts

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BETTER PLATING
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of the F-235 are carried in a housing which is connected to the top of the reflector by means of a latch assembly having no bolts. Four captive latches

Hygrade Miralume F-235

enable the reflector to be safely, easily, and quickly removed for cleaning.

The Hygrade Miralume F-235 is equipped with Hygrade's patented Mirastats, which are said to ensure positive starting and restarting. The Mirastats are so located that they can be easily reached, thereby making it possible to remove or replace starters by a twist of the wrist without moving the lamps. The F-235 is supplied completely wired and assembled, corrected for power factor, equipped with Hygrade's Dua-Lamp Auxiliary, and approved by Underwriters' Laboratories, Incorporated.

Hanson-Van Winkle-Munning Bright Copper Plating Process

A bright copper plating process, developed by Dr. Louis Weisberg, is now being marketed by the Hanson-Van Winkle-Munning Company, Matawan, N. J. Due to the shortage of nickel, many concerns have been contemplating applying heavy copper deposits followed by comparatively light nickel coatings as a means of saving nickel.

The basic ingredients of the bright copper plating solutions are copper sulfate, diethylene triamine, and ammonium sulfate. The copper is in the bivalent form.

The current efficiency at both anode and cathode is said to be practically 100 per cent and the throwing power compares favorably with a cyanide copper solution.

For optimum brightness, an average current density of about 40 amperes per square foot is recommended. The bright plating range extends from practically zero to over 100 amperes per square foot on certain types of work. A moving cathode is recommended.

Operating temperature is approximately 140 deg. F. Rubber lined equipment such as tank and filter is required. Regular filtration is necessary to keep the solution clean. Heat can be provided by means of a copper coil or a Duriron heat exchanger.

A cyanide copper flash before plating on zinc or steel is required. This need not be more than a two or three minute flash, except possibly on pieces carrying heavy scale such as bumpers in which cases 0.0001 in. of cyanide copper is recommended. Either a Rochelle salt solution or an ordinary cyanide copper solution may be used for the flashing.

Paasche Pressure Feed Material Tank

The light duty, pressure feed, material tank shown in the illustration has been placed on the market by Paasche Airbrush Co., 1910 Diversey Pkwy., Chi-

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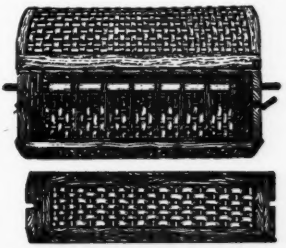
FOR SOMETHING
BETTER
SIZES FOR ANY EQUIPMENT
KING



PLATING BARRELS
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JOHN KING
48 SPRINGFIELD ST., DAYTON, OHIO

cago, Ill. The unit is provided with a six inch opening which is said to make cleaning easy.

A "Clamptight" cover with which the unit is provided can be easily taken off and placed back on the tank in less

Paasche Pressure Feed Material Tank

than 15 seconds. The Paasche light duty, pressure feed, material tank also features an accurate pressure regulator with a large easy-to-reach gauge and a large fluid tube with strainer.

The tank holds pressure up to 50 lbs. and is equipped with a safety valve. All fittings have standard ¼-in. pipe thread. This light duty pressure tank is supplied in two gallon capacity.

Pemco Low-Firing Porcelain Enamel Frits

The Porcelain Enamel & Mfg. Co., Eastern and Pemco Aves., Baltimore, Md., has placed three low-firing porcelain enamel frits on the market to be known as "Bontite," "Paradox," and "Resistayn." These frits are said to reduce firing temperatures 100 deg. F., thereby saving on fuel and enabling manufacturers to use lighter gauge metals in the fabrication of products, without the danger of warping. "Bontite," the low-firing ground coat frit, is said to offer unusual opportunities for increased production and savings on fuel. "Bontite" can be fired at 1,500 deg. F.

The low-fire Pemco white cover coat which is being marketed under the trade name of Paradox is said to embody all the features of standard cover coat frits which fire at higher temperatures, yet reduce fuel consumption through firing at 100 deg. F. lower than the usual cover coats.

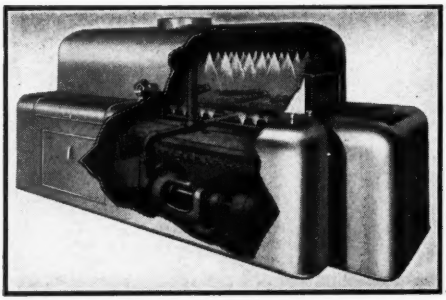
Resistayn, the stainless and acid-resisting frit, can be applied over a fired or unfired white cover coat.

The Pemco Low-Firing Porcelain Enamel Frits are recommended for finishing a wide range of products such as refrigerators, washing machines, heaters, corrugated sheets, architectural units, sinks, lavatories, hot water tanks, and signs.

Spec Cyanide Antispot

A cyanide antispot for preventing spotting out during hot and humid weather has been placed on the market by Special Chemicals Corporation, 30 Irving Place, New York, N. Y. Spec Cyanide Antispot does not contain any metallic salts and its ingredients will not contaminate plating solutions when used on the cycle racks, according to the manufacturer. A simple immersion dip as part of the regular process will check hot weather spotting out on cyanide plated products.

Spec Cyanide Antispot is especially



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International Conveyor & Washer Corp.
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effective on castings and other porous metals. To make up the solution, two to four ounces of Spec Cyanide Antispot are dissolved in a gallon of ordinary tap water. This solution is used at a temperature of 75 to 80 deg. F.

Electro-Jetal Process

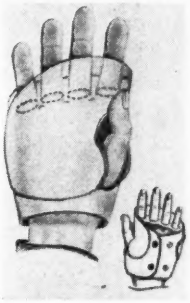
Known as the Electro-Jetal, a process which produces a black rust-proof finish on copper by anodic oxidation is announced by Alrose Chemical Co., Providence, R. I. According to the manufacturer, any metal that can be copper plated can be blackened by this process. After preplating with copper, products are immersed in a special electrolytic oxidizing bath for two to five minutes. The resulting velvety black surface of Electro-Jetal is said to provide an excellent absorptive base for an after treatment of oil, wax, or lacquer, which gives a non-porous, rust-proof finish equivalent to any ordinary nickel plate.

The Electro-Jetal bath can be operated at any temperature below the boiling point of water, using ordinary steel containers heated by a steam coil. Work can be oxidized on racks, in bulk, or in baskets.

Fingerless Hand Guard

A chrome leather fingerless hand guard has been designed by Industrial Gloves Corporation, 700 Garfield Blvd., Danville, Ill., specifically for use in handling corrugated sheets and flatware of all kinds. With an extra leather patch over the palm section, the guard fits snugly but gives absolute freedom and flexibility for picking up, catching or handling thin materials.

The Fingerless Hand Guard is made in three sizes with adjustable snap buttons for fastening up the back. The gloves are available in pairs, or for the left or right hand only, as required. The glove has wide application not only in the metal industry, but in all industries

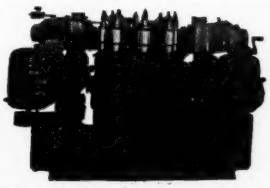


Fingerless Hand Guard

wherever protection is required for palm only with fingers and thumb left free.

DeVilbiss Automatic Shell-Coating Machine

A machine designed to coat both the inside and outside of shells automatically, substantially speeding up the production of these vital national defense items, has been developed and made available to manufacturers by the DeVilbiss Company, Toledo, Ohio. The machine operates automatically and is capable of coating shells ranging in size from 37 mm. to 105 mm., thus covering practically all sizes used in modern combat.



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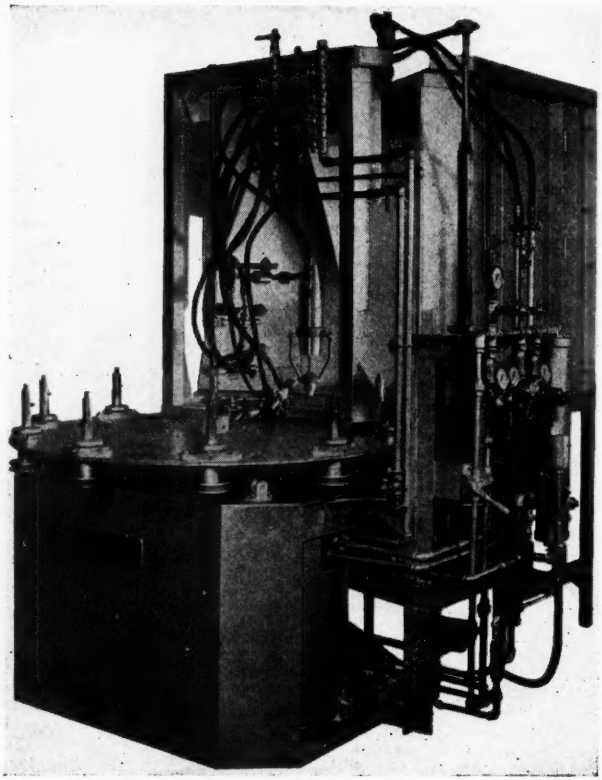


This DeVilbiss Automatic Shell - Coating Machine Coats from 300 to 720 Shells Per Hour, Inside and Out

Operation of the machine is entirely automatic with the exception of loading and unloading shells on the holding spindles (a manual detail). The spindles themselves are located around the edge of a rotating table. To the rear of this table is an overhead spray gun equipped with an extension nozzle for the interior coating operation. As the shell comes into proper position, rotating on its spindle, the gun is inserted automatically into the shell and sprays all interior surfaces.

This step completed, the gun nozzle moves from the interior of shell and the table revolves to the exterior painting position. With the shell still rotating on its spindle, a properly located battery of automatic guns goes into operation, coating the exterior of the shell. Synchronization is such that while the interior of one shell is being coated, the exterior of the preceding shell is being sprayed.

Actual rate of production obtainable with the DeVilbiss shell coating machine varies according to the size of shell or shell part. However, the machines are designed to coat from 300 to 720 shells an hour with all spindles continually loaded.

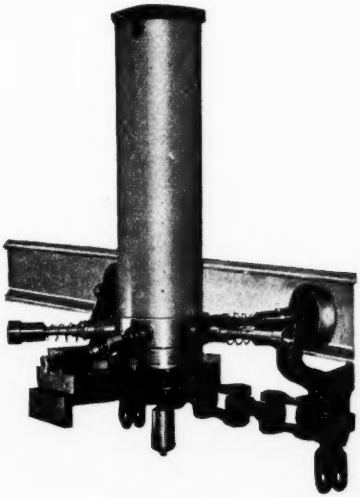
All auxiliary equipment — air pressure regulators, air pressure gages, air condensers, and hand control valves — are conveniently mounted. The assembly includes two pressure feed tanks for the finishing material. Spray booths supplied with the DeVilbiss machines are designed for the effective removal of overspray and fumes from both internal and external stations. Either dry or water wash exhaust systems are available.

In addition to shells, the DeVilbiss machines are being used to coat tail pieces and fragmentary bomb sub-assemblies. Production on the former is up to 2400 an hour; on the latter, up to 300 an hour.

Fauver Automatic Conveyor Chain Lubricator

To solve the problem of lubricating the chain links of conveyors passing through ovens, kilns, and other hot zones, J. N. Fauver Co., Inc., 49 W. Hancock Ave., Detroit, Mich., is now offering the automatic conveyor chain lubricator shown here. The lubricator

consists of a 2-gal. capacity tank connected to the plant air line, together with an air regulator set at 80 lb. pressure to ensure effective control and operation of the outfit.



Fauver Automatic Conveyor Chain Lubricator

Air passing through the lubricator picks up a predetermined and adjustable amount of lubricant and delivers it in the form of an oil fog through ⅝-in. O.D. copper lines to both sides of the chain links. Acheson-Colloidal graphite is employed as the lubricating agent, and the mixture and its application are so controlled as to ensure each chain pin being lubricated its entire length every trip without any excess lubricant remaining to cause drip. The spray of lubricant is easily adjusted to conform with kiln temperature and chain speed. The action is entirely automatic. An electric solenoid valve on the lubricator inlet line is wired to the starting switches of the chain drive motors so that the lubricator commences operating as soon as the conveyor starts and operates continuously and automatically.

In addition to producing uniform conveyor speed and hence more even baking, curing, and firing processes, the application of the Fauver Lubricator is claimed to effect economies in lubricant, a reduction in maintenance costs, and an important saving in down time due to conveyor stoppage resulting from improper lubrication.

G-E Splashproof Tri-Clad Motor

A line of Tri-Clad splashproof, ball bearing, polyphase induction motors in sizes from 1 to 15 h.p. has been announced by the General Electric Co., Schenectady, N. Y. The motors are especially designed to meet the requirements of applications where splashing water and other liquids are present, such as in industrial plants, laboratories, and so on.

The G-E Splashproof Tri-Clad Motor features functionalized styling, modern streamlined appearance, and triple protection — protection against physical damage, electrical breakdown, and operating wear and tear. Outstanding features include a sturdy cast iron stator frame and end shields that are said to resist rust and corrosion, For-

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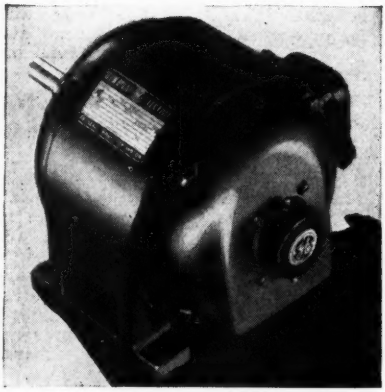


G-E Splashproof Tri-Clad Motor

mex wire windings which are highly resistant to moisture, and thoroughly protected ball bearings.

The ventilated openings of the stator frame and end shields are carefully baffled to block the entrance of splashing liquids. An ingenious arrangement of cast baffles within the side openings of the stator frame effectively blocks splashing from the side.

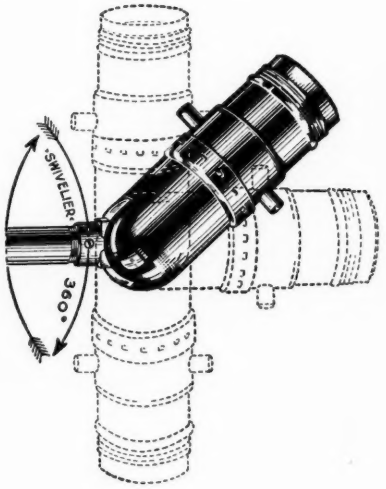
The windings of the motor are of Formex, G-E's heat and solvent-resistant magnet wire, carefully wound and impregunated with a special synthetic resin varnish. As a further protection, the windings have a covering coat of Glyptal No. 1201 Red.

Cast iron housings machined to close tolerances enclose the ball bearings for complete protection. The outer portion of each housing is part of the end shield itself, thus eliminating external joints and fits.

Ample space for making connections easily and quickly is provided by a liquid-tight cast iron conduit box which is built into the frame of the motor.

"Swivelier" Lamp Socket

Designed for use on work benches, lathes, drill presses, work presses and tables, sanding machines, foot and power presses, and so on, the "Swivelier" Lamp Socket shown herewith is now being manufactured by Reliance Devices Co., 140 Liberty St., New York, N. Y.



"Swivelier" Lamp Socket

Wired the same as ordinary brass shell sockets, the unit is adjustable to a full 90 deg. and can be rotated to 360 deg.

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BURNISHING
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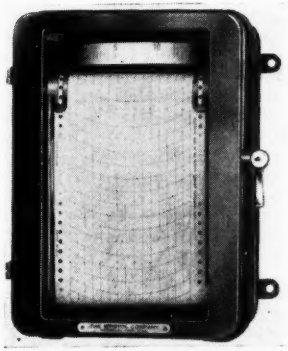
when adjusted at any angle. Due to a special stop, wires of the socket are said to be prevented from twisting.

According to the manufacturer, the patented construction of the Swivelier enables the unit to remain fixed in any position even when vibrated.

Bristol Strip-Chart Recorder

A newly designed strip-chart recorder is now offered by The Bristol Company, 66 Bride St., Waterbury, Conn. According to the manufacturer, many changes have been made in the construction of these new instruments, including the case design, chart drive, measuring elements, and writing mechanism.

The Bristol Strip-Chart Recorders are available for recording on a six-inch strip chart: d.c. volts and millivolts, d.c. amperes and milliamperes, pressure,



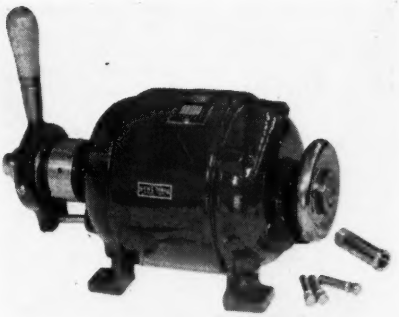
Bristol Strip-Chart Recorder

liquid level, flow, temperature, motion, and for remote recording, using Bristol's Metameter System of Telemetering.

C. W. C. Speedy Polishing Lathe

Realizing the need, with stepped-up production demands, to free precision bench lathes for other uses, the C. W. C. Corporation, Hawthorn, Cal., has placed on the market the Speedy Polishing Lathe shown in the illustration. The lathe is designed to finish turret lathe products, remove tool marks, polish round parts, as well as for lapping and burnishing.

An outstanding feature claimed for the C. W. C. Speedy Polishing Lathe is its ability to automatically hold work



C. W. C. Speedy Polishing Lathe

having considerable variation in diameter without readjusting collet tension. The draw tube, being hollow, permits polishing of extremely long pieces.

"Brightboy" Half Round Tablet

Designed to speed the finishing and polishing of curved metal surfaces, the "Brightboy" Half Round Tablet shown in the illustration has been developed

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RUST INHIBITIVE

Formulated specifically for the following properties:

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3. Tenacious adhesion
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is used and recommended as a clear coating for hand tools, machine tools, hardware and wherever a clear protective coat for bright metal is required.

The Varnish Products Co.
5208 Harvard Ave. Cleveland, Ohio

by the Weldon Roberts Rubber Co., Brightboy Division, 6th Ave. and N. 13th St., Newark, N. J. The tablet is made in the same compound as the other Brightboy products; namely, a

"Brightboy" Half Round Tablet

soft rubber binder which cushions the abrasive. It is semi-circular in cross-section and both inner and outer surfaces may be used, the inner surface being corrugated for faster action.

Almost as pliable as a rubber eraser, the Brightboy Half Round Tablet may be compressed by the hand to conform to the diameter of tubing or shafting, or it may be squeezed into the hollow of tubes, bushings, or flanges. It is said to finish and polish such surfaces quickly and effectively.

M.S.A. Coolband

A modern perspiration retainer for men on hot jobs to be known as "Coolband" has been placed on the market by Mine Safety Appliances Company, Braddock, Thomas and Meade Sts., Pittsburgh, Pa. The "Coolband" is said to stop continual face mopping and other deterrents to continuous work arising from uncontrolled head perspiration.

The M.S.A. Coolband offers all-around-the-head absorption. In consists of a soft flexible band which encircles the head and clings softly without binding, thus creating a cooling effect through constant absorption of perspiration. Sanitation is easily maintained, and any part of the band can be quickly and easily wrung out.

Radi-Aire Circulator Equipped with Safety Switch

Reco Radi-Aire Circulators manufactured by Reynolds Electric Company, 2650 W. Congress St., Chicago, Ill., are now equipped with Reco Safety Mercury Control Switches. The unit is designed for use in chemical and paint plants and similar places where highly flammable materials are used and where arcing or sparking would be dangerous.

Radi-Aire Circulator Equipped with Safety Switch

The unit consists of three mercury tubes operated by cam arrangement, which tilts one tube at a time and thus provides three speed control. The speed control is obtained by a choke coil. Tubes, coil, and mechanism are enclosed in a chrome plated steel cabinet 3½ by 7 by 3½ inches.

The control knob operates the mercury tubes which make and break the circuit and the arc is entirely enclosed. The sequence of operation is 1-2-3 and off. The safety device can easily be adapted for operating other electrical equipment in places where flammable materials are used.

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MOTOR GENERATOR CORP., Hobart Square, Box PF-71, TROY, OHIO

Airstream Air Cleaner

A new filter, to be known as the Airstream Air Cleaner, is now being manufactured and marketed by The Airstream Filter Corporation, 2100 Washington Ave., St. Louis, Mo. The filter is made in the form of units.

Each unit has face dimensions of 30 in. by 30 in., an air capacity of 3,000 c.f.m., and is designed for assembly in multiples of any desired width and height to meet a given capacity. The bottom section is used for each vertical group of units in a complete installation.

Air enters from the left of the unit. It rises through a horizontally mounted glass mat saturated by a water spray from above, passes to the right through two vertically mounted glass mats, and out to the right.

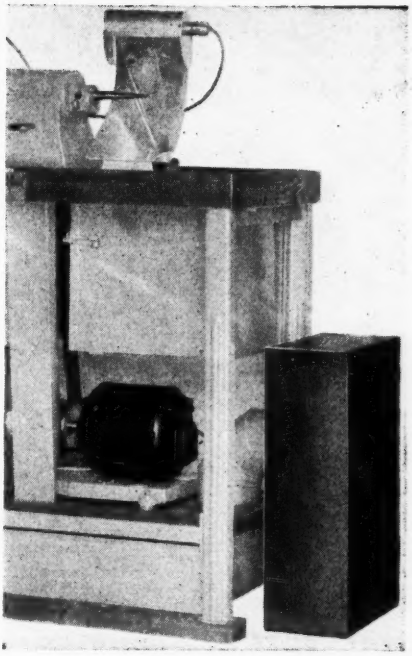
Counter flow of air and water washes dirt from the horizontal mat into the sump in the bottom section. Two other mats serve to remove entrained moisture. Especially designed, patented seals prevent air leakage around the mat edges to insure continued satisfactory operation.

Construction of the unit is in corrosion-resisting iron coated with corrosion-resisting material. The water supply connection is designed so spray head may be removed without disturbing the rest of the assembly.

All parts of the unit are manufactured to the greatest possible accuracy, thus assuring long life and satisfactory service.

Leiman Auxiliary Dust Filter

An auxiliary dust filter for use with dust collecting outfits and cyclone dust tanks has been developed by Leiman Bros., 101-W-5 Christie St., Newark, N. J. Measuring 8 x 16 in. and 25 in. high, the filter contains a spun glass filter pad through which the air must travel before emerging from the machine and re-entering the room or being blown outdoors. By means of the pad, every fine particle of dust is said to be removed.



Leiman Auxiliary Dust Filter Attached to Dust Collecting Outfit

The Leiman Auxiliary Dust Filter is available in several sizes and is readily fitted to the outlet of a dust collector tank or cyclone.

Eclipse Shell Painting Unit

The Eclipse Air Brush Company, 400 Park Ave., Newark, N. J., is building automatic spray equipment to handle the coating of the inside of trench mortar shells or other objects having a conical interior.

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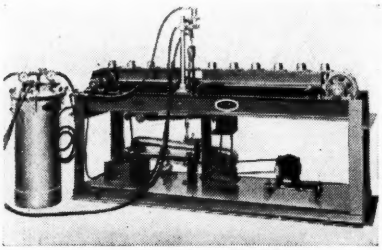
The machine is entirely automatic except that the shells are put on and removed manually. The shell is placed in a holder on a chain belt; it is carried along until it comes up to an automatic



Eclipse Shell Painting Unit

spray gun where it is elevated on a special device that spins it as it fits over an extension nozzle attached to the automatic spray gun.

The timing of the machine is so arranged that an even coating is obtained on the cone-like interior, and the machine will not spray unless there is a shell in the holder. Rate of operation is 1,000 an hour, using only 15 lbs. pressure on the material and 20 lbs. on the air.

Ace Shaker

A shaker for separating sawdust, emery, burnishing balls, and so on, from small parts to be known as the "Ace" Shaker has been placed on the market by Ace Engineering & Machine Co., 3644 N. Lawrence St., Philadelphia, Pa. This shaking device provides a rotary oscillating movement that produces a thorough agitation without dead spots. An 18 in. sieve which can be moved and easily emptied is provided as standard equipment. The unit is completely enclosed, thus permitting no sawdust, water, and so on, to get into moving parts. The sawdust or balls fall into a drawer at the bottom of the unit.

The Ace Shaker is driven by a 1/3 h.p. Master gear head motor which can be furnished in 110 to 220 volt, a.c. or d.c. The main shaft is supported on two totally enclosed ball bearing units.

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Birdseye Direct Reflector Lamp

Industrial plants generating their own electric current will be especially interested in the new "sealed-silver" high voltage Birdseye Lamp that the Wabash Appliance Corporation, 335 Carroll St., Brooklyn, N. Y., has placed on the market. The new lamp is made with its own built-in reflector unit in the form of a solid silver lining hermetically sealed inside the bulb where it cannot gather dust, or tarnish, crack or peel.

A nickel neck flector disc redirects light that would ordinarily be wasted through the neck of the bulb. The combination of neck reflector disc, pure silver lining and exact optical placement of the filament is said to direct a concentrated flood of light rays straight out of the bulb direct to the work area to be illuminated.

Birdseye Direct Reflector Lamp

These new lamps are being made in six sizes from 100 to 1,000 watts, and in seven different high voltages from 220 up to 300 volts.

"Standard" Speed Lathe with Double End Arrangement

The Standard Electrical Tool Co., 1941 W. 8th St., Cincinnati, Ohio, has added to its line of speed lathes a lathe

having a double end arrangement as shown in the illustration herewith. The construction of the unit permits the spindle at each side to be operated at

"Standard" Speed Lathe with Double End Arrangement

random, thus it is possible to start and stop one side without interfering with the operation on the opposite end.

Incorporated in each spindle housing is a combination clutch and brake which is actuated either through a hand lever as illustrated or by foot pedal control. Simultaneous action disengages the clutch and applies the brake, which instantly stops the work spindle, while the motor continues to operate. Slight pressure on the hand lever or foot pedal places the work spindle in neutral position.

The illustration shows the "Standard" Double End Speed Lathe equipped with a three-jaw drill chuck on each end of spindle. Optional equipment includes a universal lathe chuck, Morse taper socket or collet chuck.

Increased production due to the facility of quickly starting and stopping the work spindle is said to be reflected by the double end arrangement of the lathe. Each work spindle being independent of the motor shaft permits the motor to operate at all times, thus eliminating frequent starting and stopping and reflecting in low current consumption and long motor life with a minimum amount of maintenance. The motor operates only through a toggle switch at the front of the machine.

Available in sizes of ½, 1, and 2 h.p. with any standard motor speed, the Standard Double End Speed Lathe serves two operators independently, thus conserving floor space.

Towmotor Model LT-44 Lift Truck

The Towmotor Co., 1228 E. 152nd St., Cleveland, Ohio, has introduced the Model LT-44 lift truck shown in the illustration herewith which is capable of lifting 4,000 lb. at 15 in. from the carriage. The truck has a 44-in. wheel base with a turning radius of only 72 in., thus making it ideal for use in overcrowded quarters. The overall width of the truck is 35 in. and the overall length (without forks) is 74 in. The unit can be equipped with low, medium, and high telescopic lifts up to 132 in., and, in addition to standard load carrying forks, is also available with interchangeable attachments for special purposes, such as rams, scoops, flat plates, and special loading devices.

Powered by a 27½ h.p., four-cylinder gas engine with degasser and governor, the Towmotor Model LT-44 Lift Truck is said to travel at speeds of from 1 to 10 miles per hour, with two speeds forward and two in reverse obtained by a special transmission having only four gear elements. By means of the hydraulic lifting and tilting system, the unit will lift and stack rated loads accurately to heights of 7, 9, and 11 ft. at the rate of approximately 40 ft. per minute.

The LT-44 is streamlined in appearance with a rugged, all-steel arc welded frame. Design improvements are as follows: entire motor assembly and battery

Plating Rectifiers

B-L Rectifiers are an ideal source of low voltage—high current for electroplating, metal refining, and other electro-chemical applications.

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The Benwood Linze Co.
1850 WASHINGTON AVE., ST. LOUIS, MO.

Towmotor Model LT-44 Lift Truck

instantly accessible by lifting driver's seat; specially designed transmission case which permits removal of air ventilated clutch plate without disturbing motor or transmission; front (driving) axle housing designed as an integral part of the frame, thus ensuring proper alignment of drive axle with transmission and power plant.

The unit has a full-width, upholstered seat located at the center of the machine for increased driver comfort and safety. Controls are located well forward convenient to operator, thereby simplifying operation and providing increased leg room for easy entrance and exit.

Brabender Temperature Control

Temperature control within accuracy of 1/10 deg. C. is said to be possible with an adjustable electric contact thermometer known as the Thermo-Regulator which has been placed on the market by Brabender Corp., Rochelle Park, N. J. Temperature ranges of 85 to 175 deg. C. and from 30 to 200 deg. F. are available.

The Thermo-Regulator consists of a glass column and two temperature scales enclosed in a metal and glass case. The column is divided into two sections with electrical contact bridge located between them. The lower section contains mercury and the upper section consists of a glass covered iron rod which is controlled by a movable sliding magnet clamped to the outside of the case. Attached to the iron rod is a thin wire which extends from a contact bridge to the mercury of the lower section. Another electrical contact is in the lower part of the thermometer below the mercury column.

The mercury on rising establishes contact with the thin wire, thus closing the circuit. When the temperature drops, the mercury contracts and the circuit is opened. The temperature setting can be made by moving the magnet to the desired position on the scale.

The Thermo-Regulator operates on 110 volts, 5 to 10 milliamperes. A primary relay which passes 5 milliamperes and is capable of a 220 watt load is also available.

Guard for Air Motored Mixer

A metal ring guard that also acts as a stand is now available on clamp-type portable Pneumix air-motored agitators made by the Eclipse Air Brush Company, 400 Park Ave., Newark, New Jersey.

The ring protects the propeller from contact with the mixing vessel when in use, and provides an easy means of storage as it eliminates the necessity for suspending the mixer when not in use.

For a real good polishing job use

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TURKISH — NAXOS — AMERICAN

KEYSTONE EMERY MILLS *Write for Sample* 4316 Paul St., Phila, Pa.

The four metal supports that hold the ring in place protect the shaft and prevent its getting out of alignment. Two

Pneumix Air-Motored Agitator equipped with Metal Ring Guard

metal handles alongside the air motor, at the top of the frame, facilitate lifting the agitator from the mixing vessel.

The addition of the guard in no way affects the features of the Pneumix agitators: fire and explosion-proof performance at any speed up to 6,000 r.p.m.

Metlseel

The Porcelain Enamel and Manufacturing Company, Eastern and Pemco Aves., Baltimore, Md., has developed a material called Metlseel which prevents corrosion and disintegration of metal parts exposed to gaseous atmospheres at furnace temperatures. With the increasing difficulty of obtaining heat-resisting alloy steels due to priority rulings, it is believed that Metlseel will be of interest to the heat-treating industry.

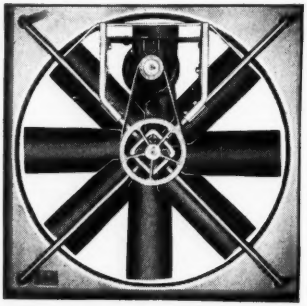
Metlseel, which is applied as a liquid coating, is said to withstand heat in excess of 1,500 deg. F., prevent oxidation, and keep metal parts sound and clean.

"Allvent" All Purpose Ventilating Fan

An all purpose, quiet operating, ventilating fan for industrial and commercial applications is now being manufactured by Autovent Fan & Blower Co., 1805-1827 N. Kostner Ave., Chicago, Ill., under the trade name of "Allvent." Formerly available with three-bladed construction, the fan has been redesigned so that it is now supplied as a multiple-bladed unit.

The new blade assembly is designed to overcome normal restrictions in the air flow, to prevent "churning" the air and, at the same time, absorb shocks and sudden changes in air loads which might overtax motor capacities. The new type fan wheel is said to deliver a

maximum volume of air at lowest power consumption. Operation of the fan is with V-belt drive from a standard



"Allvent" All Purpose Ventilating Fan

speed (1,725 r.p.m.) motor.

The Allvent All Purpose Ventilating Fan is furnished in capacities of 5,000 to 23,000 c.f.m. inclusive and is ruggedly constructed, with all parts die-formed. Fan blades are of 14 or 12 gauge sheet steel, depending on fan size. Units up to 36-in. diameter have six blades and sizes up to 54 in. have eight blades. The assembly is rigidly held in place by four tubular steel supports welded to a square panel of 16, 14, or 12 gauge sheet steel, depending upon the size of the assembly. The panel has a 1½-in. flange all around, with holes punched for easy mounting.

Aluminum finished with a red enamel-coated wheel, the Allvent Fan bears the certified ratings of the National Association of Fan Manufacturers and American Society of Heating & Ventilating Engineers.

Howell Protected Motor

Illustrated herewith is the Howell Protected Motor which has been placed on the market by Howell Electric Motors Co., Howell, Mich. The motor is of the open type and is said to be completely protected against dripping liquids, metal chips, or other falling particles.

The motor frame is fabricated from heavy steel plate. The laminations are first riveted together, then pressed into the frame, and finally made permanent by electric welding. The base is made

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of malleable iron firmly attached to the frame, and is designed to withstand practically any external blow or accidental abuse.

The end plates are high grade cast iron, accurately machined and diamond bored for the bearings. Each end plate has but one opening (for ventilation). This opening is located well below the center line of the motor and is protected on the top and both sides. The ventilating fan is extra large to provide efficient ventilation of all working parts. The motor is rated 40 deg. C. rise.

The Howell Protected Motor can be furnished with either ball or sleeve bearings. Highest quality selected ball bearings are used. Sleeve bearings are made of high grade phosphor bronze, diamond bored for accuracy. The terminal box is cast iron, both water and dust-tight, easily accessible for wiring, and adjustable to four positions.

Standard NEMA dimensions are maintained throughout all sizes of the motor. Motors of the same frame size are interchangeable with all ordinary type motors which adhere to NEMA dimensions.

The Howell Protected Motor is streamlined, all exterior surfaces being smooth and symmetrical, and is finished in a high gloss, durable, gray enamel. The motor is recommended for any application where open type motors

Howell Protected Motor

are ordinarily used and is said to be ideal for driving machines and equipment where the atmosphere is not entirely moisture or dirt-free. Where required, special horizontal or vertical mountings can be furnished.

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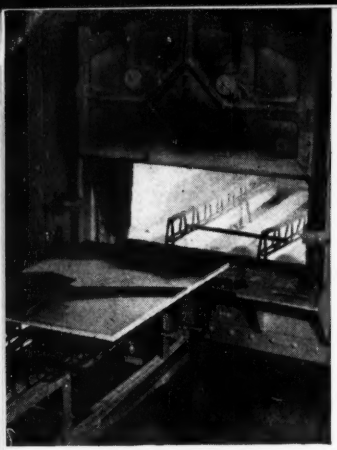

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The complete line of Lyon Trucks with hydraulic elevating tables is illustrated and described in a bulletin designated as No. 122 which is now being issued by Lyon Iron Works, 762 Madison St., Greene, New York.

2. Chromium Chemicals

The discovery, development, and use of chromium chemicals are outlined in a 36-page booklet entitled "Chromium Chemicals" which is now being issued by Mutual Chemical Company of America, 270 Madison Ave., New York City.

3. Infra-Red Radiant Energy for Drying and Baking

Bulletin No. 150 describing industrial applications of infra-red radiant energy for drying and baking is now being issued by Gifford-Wood Co., Hudson, New York.

4. Portable Vapor Degreasing Units

A four-page folder describing Phill-Co Portable Degreaser Units is now being issued by Phillips Manufacturing Company, 340 W. Huron St., Chicago, Ill.

5. Heavy Duty Grinders and Buffers

The complete line of Marschke Heavy Duty Grinders and Buffers manufactured by Vonnegut Moulder Corporation, 1845 Madison Ave., Indianapolis, Ind., is illustrated and described in a 22-page catalog now being issued by the company.

6. Hammond Variable Speed Lathe

A four-page folder illustrating and describing a method by which speed changes of 1,500 to 3,000 r.p.m. can be obtained instantly on the Hammond VRO Polishing and Buffing Lathe is now being issued by Hammond Machinery Builders, Inc., 1622 Douglas Ave., Kalamazoo, Michigan.

7. Finishes for Jewelry and Novelties

Five standard finishes for jewelry and novelties, rhodium, white gold No. 2, Wite brass, and gold smut base finishes are described in a folder which is now being issued by the Alrose Chemical Company, 80 Clifford St., Providence, Rhode Island.

8. General Electric Immersion Heaters

Bulletin GEA-3195 now being issued by General Electric Company, Schenectady, N. Y., tells how to heat electroplating baths with General Electric Immersion Heaters.

9. Viscosity Determination

A data sheet describing the General Electric Zahn Viscosimeter for determining the viscosity of paints is now being issued by General Electric Company, Schenectady, New York.

10. Airway Ventilated Buffs

Cool cutting buffs for high speed buffing operations are illustrated and described in a 4-page folder now being distributed by Jackson Buff Corporation, 20-03 41st Ave., Long Island City, New York.

11. Industrial Ovens

An illustrated industrial oven book featuring safety, speed, economy, and efficiency in industrial drying and finishing processes is now being issued by The Kirk & Blum Mfg. Co., 2816 Spring Grove Ave., Cincinnati, Ohio.

12. Finishing Equipment Catalog

A very complete catalog illustrating and describing finishing equipment of all kinds is now being issued by Industrial Sheet Metal Works, 630 E. Forest Ave., Detroit, Michigan.

13. Milburn Gas and Air Regulators

A special portfolio describing Milburn single, two-stage, and ball seat type gas and air regulators is now being issued by The Alexander Milburn Company, 1436 W. Baltimore St., Baltimore, Md.

14. Grinding Wheel Data Book

A 112-page catalog containing complete descriptive information about the manufacture, use and application of grinding wheels is now being issued by Abrasive Company, Tacony and Fraley Sts., Philadelphia, Pennsylvania.

15. Orvus for Alkaline Cleaning Baths

All those engaged in metal cleaning operations will be interested in information regarding an alkaline cleaning bath addition agent known as Orvus now being distributed by Procter & Gamble Co., Gwynne Bldg., Cincinnati, Ohio.

16. Dust Control

A complete story of dust control in words and pictures by means of Roto-Clone dust control equipment is now being issued by American Air Filter Company, Inc., 702 Central Ave., Louisville, Kentucky.

17. Cleaning of Metals Before Electroplating

A 32-page booklet outlining formulas and methods for cleaning many different metals and alloys before electroplating is now being issued by Oakite Products, Inc., 20 Thames St., New York City.

18. Du Pont High Speed Brass

The Electroplating Division of E. I. du Pont de Nemours & Company, Wilmington, Del., is now issuing a catalog describing an electroplating process for the rapid production of smooth, bright brass deposits.

19. Metal Cleaning Tips

The chemical classification and selection of alkaline metal cleaners is contained in a bulletin which has been prepared and is now being distributed by the Cowles Detergent Company, 7016 Euclid Ave., Cleveland, Ohio.

20. Hy-Speed Filter Equipment for Plating Solutions

An 8-page catalog now being issued by Alsop Engineering Corporation, 8 Bright St., Milldale, Conn., describes an entirely new approach to the problem of keeping plating solutions clean.

21. Textured Enamel Finish

An improved textured enamel finish known as Rincontrol is fully illustrated and described in a folder now being issued by Roxalin Flexible Lacquer Co., Inc., Box 713, Elizabeth, New Jersey.

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